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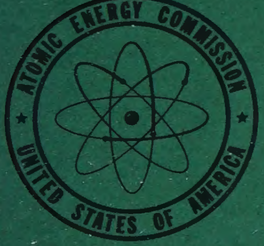

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ERRATA

NSA, Vol. 5, No. 24. In Numerical Index of AEC Reports,

for AECD-2490, journal reference should be Phys. Rev. 78, 649-55(1950).
for AECU-593, journal reference should be Phys. Rev. 77, 759(1950).
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NSA, Vol. 6, No. 3. In abstract 925, INTEGRATION in the title should be INTERACTION.

REPORTS REFERENCE LIST

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U. S. ATOMIC ENERGY COMMISSION DECLASSIFIED REPORTS

AECD-3243(Rev.) **1414**
Argonne National Lab.
LATTICE VIBRATIONS IN GRAPHITE, by R. Gurney. [nd] Decl. Jan. 24, 1952. 3p. (AECD-3243(Rev.))

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AECD-3296 **1422**
Argonne National Lab.
Excerpts from THE METABOLISM OF CARRIER-FREE FISSION PRODUCTS IN THE RAT, by K. G. Scott, R. Overstreet, L. Jacobson, J. G. Hamilton, H. Fisher, J. Crowley, I. L. Chaikoff, C. Entenman, M. Fishler, A. J. Barber, and F. Loomis. [nd] Decl. with deletions Jan. 25, 1952. 19p. (AECD-3296; ADF-494)

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Tennessee Univ.
NATURE OF LIQUID FLOW WITHIN A SPHERICAL CONTAINER; SECOND QUARTERLY REPORT; by H. J. Garber and F. N. Peebles. Dec. 15, 1951. 48p. (AECU-1824)

AECU-1825 **1543**
Nuclear Physics Lab., Case Inst. of Tech.
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AECU-1838 1491
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North Carolina State Coll.
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α- AND β-BANDS IN POTASSIUM BROMIDE CRYSTALS, by Charles Delbecq, Peter Pringsheim, and Philip Yuster. Jan. 1952. 4p. (AECU-1844; UAC-497)

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FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION; TECHNICAL PROGRESS REPORT NO. 5, SCOPE III; by B. L. Averbach, M. Cohen, S. Allen, G. P. Conard, and P. Fopiano. Dec. 31, 1951. 4p. (NYO-860; Technical Progress Report No. 5, Scope III; D.I.C. 6802)

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NYO-1639 1379
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NYO-3181 1473
Metals Research Lab., Carnegie Inst. of Tech.
PROGRESS REPORT FOR OCTOBER, NOVEMBER, DECEMBER, 1951; by R. Smoluchowski, L. Couling, S. Hayes, R. Flanagan, C. W. Haynes, R. W. Turner, and S. Toney. Jan. 15, 1952. 4p. (NYO-3181)

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UTILIZATION OF WASTE FISSION PRODUCTS IN CHEMICAL REACTION, by W. A. Selke, C. Kardys, E. V. Sherry, and R. C. Jagel. Jan. 1, 1952. 7p. (NYO-3327)

ORNL-1092 1485
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QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1951; PHYSICS DIVISION; by L. D. Roberts, ed. Issued Jan. 16, 1952. 55p. (ORNL-1092)

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Oak Ridge National Lab.
NEUTRON DIFFRACTION, sect.1 of QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1951; PHYSICS DIVISION; by E. O. Wollan, C. G. Shull, W. C. Koehler, and R. A. Erikson. Issued Jan. 16, 1952. 6p. (ORNL-1092(sect.1))

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THEORETICAL PHYSICS, sect.9 of QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1951; PHYSICS DIVISION; by L. D. Roberts, ed. Issued Jan. 16, 1952. 6p. (ORNL-1092(sect.9))

SEP-83 1474
Sylvania Electric Products, Inc.
DEVELOPMENT OF POROSITY BY UNEQUAL DIFFUSION IN SUBSTITUTIONAL SOLUTIONS; by R. W. Balluffi and B. H. Alexander. [nd] 23p. (SEP-83)

SO-1006 1439
Illinois Univ. Engineering Experiment Station
COLLECTION OF AEROSOL PARTICLES BY ATOMIZED SPRAYS, by R. B. Feild. Oct. 31, 1951. (SO-1006; Technical Report No. 5)

SO-2504 1475
General Electric Research Lab.
DEVELOPMENT OF ZIRCONIUM BASE ALLOYS; NINTH QUARTERLY REPORT; by J. H. Keeler. Jan. 5, 1952. 23p. (SO-2504; RL-640; Progress Report No. 10)

UCLA-176 1380
Atomic Energy Project, Univ. of Calif., Los Angeles
ATTEMPTS TO ALTER THE RESPONSE TO IONIZING RADIATIONS, by W. A. Selle. Issued Jan. 15, 1952. 53p. (UCLA-176)

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UCRL-1473(Rev.) 1556
Radiation Lab., Univ. of Calif.
ALPHA RADIOACTIVITY OF NUCLIDES WITH ATOMIC NUMBERS LESS THAN 83 (thesis), by John Oscar Rasmussen, Jr. Dec. 14, 1951. 103p. (UCRL-1473(Rev.))

UCRL-1601 1512
Radiation Lab., Univ. of Calif.
SUMMARY OF RESEARCH PROGRESS MEETING OF OCTOBER 11, 1951; by Sergey Shewchuck. Dec. 7, 1951. 7p. (UCRL-1601)

UCRL-1613 1389
Radiation Lab., Univ. of Calif.
THE LOCALIZATION OF CERTAIN ALKALINE AND RARE

EARTH ELEMENTS IN THE COSTOCHONDRAL JUNCTION OF THE RAT; by C. W. Asling, J. G. Hamilton, Dorothy Axelrod-Heller, and Berniece Jue Louie. Dec. 18, 1951. 20p. (UCRL-1613)

UCRL-1618 1538
Radiation Lab., Univ. of Calif.
COMPARISON OF TOTAL PHOTONEUTRON YIELD FROM 160 AND 320 MEV BREMSSTRAHLUNG; by Lawrence W. Jones and Kent M. Terwilliger. Dec. 26, 1951. 4p. (UCRL-1618)

WASH-72 1487
Division of Research, AEC
PHYSICS IN THE ATOMIC ENERGY PROGRAM; by Thomas H. Johnson. Dec. 27, 1951. 13p. (WASH-72)

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

AERE EL/R-728 1505
Atomic Energy Research Establishment, Harwell, Berks (England)
A FAST SCALE OF TEN (SCALAR—TYPE 1070A); by G. A. Howells. Sept. 6, 1951. 36p. (AERE EL/R-728)

AERE-G/R-810 1493
Atomic Energy Research Establishment, Harwell, Berks (England)
ELECTROMAGNETIC RESONATORS FOR TESTING THE DIELECTRIC CONSTANT AND DIELECTRIC POWER FACTOR OF DISCS OF TITANIA CERAMIC AT ABOUT 3,000 MC/S; by J. H. Adlam. [nd] 17p. (AERE-G/R-810)

AERE Inf./Bib.-76 1529
Atomic Energy Research Establishment, Harwell, Berks (England)
A BIBLIOGRAPHY ON FISSION. July 1951. 32p. (AERE Inf /Bib.-76)

AERE Inf./Bib.-80 1423
Atomic Energy Research Establishment, Harwell, Berks (England)
ELECTROSTATIC SEPARATION OF MINERALS; A BIBLIOGRAPHY OF PUBLISHED PAPERS. Dec. 1951. 4p. (AERE Inf./Bib.-80)

AERE M/R-714 1391
Atomic Energy Research Establishment, Harwell, Berks (England)
THE FLOW OF IONS AND ELECTRONS THROUGH THIN ALUMINUM OXIDE FILMS; by A. Charlesby. 1951. 78p. (AERE M/R-714)

CRM-482 1508
Atomic Energy Project (Canada)
REPORT ON FAST NEUTRON DOSIMETRY; by J. Dainty. May 17, 1950. 46p. (CRM-482)

IM-7 1494*
Atomic Energy Project (Canada)
OPERATING AND TECHNICAL MANUAL; E. H. T. UNIT-AEP 1007A. Mar. 1950. 18p. (IM-7; N.R.C. 2399)

IM-8 1495*
Atomic Energy Project (Canada)
LINEAR AMPLIFIER TYPE AEP 1444, by N. F. Moody and W. D. Howell. Apr. 1950. 22p. (IM-8; N.R.C.-2400)

LT-29 1554
Atomic Energy Project (Canada)
THEORY OF BETA-DECAY; by M. A. Preston. Sept. 15, 1950. 88p. (LT-29)

ML-153 1545
Microwave Lab., Stanford Univ.
RADIATIVE CORRECTION TO THE ANGULAR DISTRIBUTION OF NUCLEAR RECOILS FROM ELECTRON SCATTERING; by L. I. Schiff. Dec. 1951. 8p. (ML-153)

ML-154 1488
Microwave Lab., Stanford Univ.
NEUTRAL V PARTICLE DECAY AND THE NEGATIVE PROTON; by L. I. Schiff. Dec. 1951. 4p. (ML-154)

NACA-RM-E51H31 1496
Lewis Flight Propulsion Lab.
A MULTIPLE-RANGE SELF-BALANCING THERMOCOUPLE POTENTIOMETER; by I. Warshawsky and M. Estrin. Nov. 5, 1951. 15p. (NACA-RM-E51H31)

NBS-1281 1497
National Bureau of Standards
QUARTERLY PROGRESS REPORT OF THE OFFICE OF BASIC INSTRUMENTATION; FOR THE QUARTER ENDING SEPTEMBER 30, 1951. [nd] 41p. (NBS-1281; U20260)

NBS-1355 1429
National Bureau of Standards
FLUORINE SUBSTITUTION IN HYDROUS SILICATES AND RELATED MINERALS; by A. Van Valkenburg and R. Pike. Dec. 10, 1951. 4p. (NBS-1355)

NBS-1368 1430
National Bureau of Standards
SYNTHESIS OF D-GLUCOSE-1-C^{14} AND D-MANNOSE-1-C^{14}; by H. S. Isbell, J. V. Karabinos, H. L. Frush, N. B. Holt, and A. Schwebel. Dec. 31, 1951. 43p. (NBS-1368)

NEPA-1262 1447
NEPA Div., Fairchild Engine and Airplane Corp.
ALUMINA, by Helen M. Lee. June 27, 1950. 103p. (NEPA-1262)

NEPA-1406 1466
NEPA Div., Fairchild Engine and Airplane Corp.
THE PRESENT STATUS OF THE ART OF MOLYBDENUM FABRICATION; by C. E. Swartz. May 10, 1950. 21p. (NEPA-1406)

NEPA-1580 1498
Armour Research Foundation
THE DEVELOPMENT OF THERMOCOUPLES FOR TEMPERATURES IN THE REGION OF 1600° to 2000°C; FINAL REPORT. SEPT. 18, 1950. 115p. (NEPA-1580)

NP-3538 1516*
Massachusetts Inst. of Tech.
RESEARCH ON TURBULENCE AND DIFFUSION OF PARTICULATE MATTER IN THE LOWER LAYERS OF THE ATMOSPHERE; AUGUST 1–OCTOBER 31, 1950; by E. Wendell Hewson. Nov. 10, 1950. 46p. (NP-3538; Progress Report No. 8; U19653)

NP-3539 1517*
Massachusetts Inst. of Tech.
RESEARCH ON TURBULENCE AND DIFFUSION OF PARTICULATE MATTER IN THE LOWER LAYERS OF THE

ATMOSPHERE; MAY 1–JULY 31, 1950; by E. Wendell Hewson. Aug. 10, 1950. 15p. (NP-3539; Progress Report No. 7; U17819)

NP-3540 1518
Massachusetts Inst. of Tech.
RESEARCH ON TURBULENCE AND DIFFUSION OF PARTICULATE MATTER IN THE LOWER LAYERS OF THE ATMOSPHERE; NOVEMBER 1, 1949–JANUARY 31, 1950; by E. Wendell Hewson. Feb. 10, 1950. 40p. (NP-3540; Progress Report No. 5; U15660)

NP-3541 1519
Massachusetts Inst. of Tech.
RESEARCH ON TURBULENCE AND DIFFUSION OF PARTICULATE MATTER IN THE LOWER LAYERS OF THE ATMOSPHERE; NOVEMBER 1, 1950–JANUARY 31, 1951; by E. Wendell Hewson. Feb. 10, 1951. 47p. (NP-3541; Progress Report No. 9; U19942)

NP-3542 1520
Massachusetts Inst. of Tech.
RESEARCH ON TURBULENCE AND DIFFUSION OF PARTICULATE MATTER IN THE LOWER LAYERS OF THE ATMOSPHERE; FEBRUARY 1–APRIL 30, 1951; by E. Wendell Hewson. May 10, 1951. 33p. (NP-3542; Progress Report No. 10)

NP-3543 1443
Massachusetts Inst. of Tech.
CONSTRUCTION AND OPERATION OF APPARATUS FOR STUDY OF HEAT TRANSFER WITH SURFACE BOILING; by Warren M. Rohsenow, Edward H. Somna, and Paul V. Osborn. July 1, 1950. 63p. (NP-3543; Technical Report No. 2; U60506)

NP-3546 1376
Naval Medical Research Inst., Bethesda
PERMISSIBLE DOSAGE AND CONSIDERATIONS OF CALCULATED RISK; by C. F. Behrens. July 2, 1951. 21p. (NP-3546)

NP-3547 1541
Research Lab. of Electronics, Mass. Inst. of Tech.
THE M.I.T. LINEAR ELECTRON ACCELERATOR; by P. T. Demos, A. F. Kip, and J. C. Slater. May 31, 1951. 23p. (NP-3547; Technical Report No. 203)

NP-3550 1392
New York Univ.
RESEARCH OF FLUORESCENCE AND CONDUCTIVITY PHENOMENA; SECOND QUARTERLY REPORT FOR MONTHS INCLUDING MAY, JUNE, JULY [1951]; by Hartmut Kallmann. Oct. 1951. 55p. (NP-3550; Progress Report [No.] 2; U20215)

NP-3556 1425
Amherst Coll.
HEAT OF ADSORPTION ON CARBON ADSORBENTS; NITROGEN, ARGON AT −195°C AND METHANOL AT 0°C; 1 DECEMBER 1948 TO 1 APRIL 1950; by R. A. Beebe, B. Millard, and J. Cynarski. [nd] 36p. (NP-3556; Technical Report No. 1; U15754)

NP-3557 1521
Research Lab. of Electronics, Mass. Inst. of Tech.
CENTRIFUGAL DISTORTION IN ASYMMETRIC MOLECULES; II.-HDS; by R. E. Hillger and M. W. P. Strandberg. Oct. 5, 1950. 15p. (NP-3557; Technical Report No. 180; U61362)

NP-3560 1490
Research Lab. of Electronics, Mass. Inst. of Tech.
MICROWAVE DETERMINATION OF THE PROBABILITY OF COLLISION FOR SLOW ELECTRONS IN GASES; by Arthur V. Phelps, O. T. Fundingsland, and Sanborn C. Brown. July 23, 1951. 9p. (NP-3560; Technical Report No. 211; U20227)

NP-3561 1483
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
PROGRESS REPORT; [AUGUST 31, 1951 TO NOVEMBER 30, 1951]. Nov. 30, 1951. 72p. (NP-3561; Progress Report [No. 23]; U20309)

NP-3561(p.1-17) 1393
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
CHEMISTRY OF THE FISSION ELEMENTS, COSMIC RAY, ELEMENTARY PARTICLE SCATTERING, AND M.I.T.-O.N.R. GENERATOR CONSTRUCTION AND HIGH VOLTAGE RESEARCH GROUPS, p.1-17 of PROGRESS REPORT; [AUGUST 31, 1951 TO NOVEMBER 30, 1951]. Nov. 30, 1951. 17p. (NP-3561(p.1-17))

NP-3561(p.18-38) 1424
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
NUCLEAR CHEMISTRY (INORGANIC) GROUP, p.18-38 of PROGRESS REPORT; [AUGUST 31, 1951 TO NOVEMBER 30, 1951]. Nov. 30, 1951. 11p. (NP-3561(p.18-38))

NP-3561(p.39-70) 1533
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
NUCLEAR CHEMISTRY (ORGANIC), ONR GENERATOR, RADIOACTIVITY AND CYCLOTRON, SYNCHROTRON, AND THEORETICAL GROUPS, p.39-70 of PROGRESS REPORT; [AUGUST 31, 1951 TO NOVEMBER 30, 1951]. Nov. 30, 1951. 32p. (NP-3561(p.39-70))

NP-3562 1426
Institute for the Study of Rate Processes, Univ. of Utah
A SIMPLIFIED METHOD FOR DETERMINING SURFACE AREAS OF POROUS SOLIDS; by Wendell H. Wiser, V. Dean Allred, and Melvin A. Cook. June 1, 1951. 9p. (NP-3562; Technical report No. VI; U20310)

NP-3595 1484
Westinghouse Research Labs.
THE MEASUREMENT OF LOW TEMPERATURES; by C. T. Linder. Feb. 2, 1950. 68p. (NP-3595; Research Report R-94433-2-A)

NP-3601 1451
Department of Mines and Technical Surveys (Canada)
ACTIVATION ASSAYING FOR TANTALUM IN ORES, by G. G. Eichholz. Nov. 6, 1951. 24p. (NP-3601; TR-93/51)

NP-3610 1377
Battelle Memorial Inst.
A BIBLIOGRAPHY ON "THE EFFECTS OF X-RAY ON BACTERIA" (1896–August 1951), by Radcliffe F. Robinson, Michael D. Phillips, and Margaret G. Nagelsen. Aug. 20, 1951. 18p. (NP-3610)

NRC-1913 1416*
National Research Council of Canada. Div. of Building Research
REPORT ON SPACE REQUIREMENTS FOR SCIENTIFIC

RESEARCH LABORATORIES; by J. Lorne Gray. Jan. 1949. 10p. (NRC-1913; Technical Report No. 3)

NRL-3930 1510
Naval Research Lab.
INSENSITIVITY OF INFRARED DETECTION USING TEMPERATURE SENSITIVE PHOSPHORS, by C. C. Klick and J. H. Schulman. Jan. 15, 1952. 4p. (NRL-3930)

ONRL-77-51 1522
Office of Naval Research, London
PROBLEMS OF QUANTUM PHYSICS; COPENHAGEN, DENMARK, JULY 6–10, 1951; by S. Fred Singer and V. F. Weisskopf. Aug. 24, 1951. 31p. (ONRL-77-51; U19456)

ONRL-83-51 1523
Office of Naval Research, London
NUCLEAR PHYSICS RESEARCH AT THE UNIVERSITIES OF BRUSSELS AND LOUVAIN; by John K. Beling. Sept. 10, 1951. 11p. (ONRL-83-51; U19430)

ONRL-101-51 1371
Office of Naval Research, London
SPECTROSCOPY AND NUCLEAR RESEARCH AT THE ZEEMAN LABORATORY, AMSTERDAM; by P. M. Marcus. Oct. 23, 1951. 6p. (ONRL-101-51; U61005)

ONRL-102-51 1372
Office of Naval Research, London
INSTITUTE FOR NUCLEAR PHYSICS AT HAMBURG; by P. M. Marcus. Oct. 24, 1951. 7p. (ONRL-102-51; U60852)

RMO-838 1401
Bureau of Mines, Bluemont, Va.
ANALYTICAL PROCEDURE FOR THE DETERMINATION OF THORIUM; by R. Kronstadt and Allan R. Eberle. Issued Jan. 1952. 8p. (RMO-838)

TEI-118 1452
Geological Survey
THE QUANTITATIVE DETERMINATION OF CALCITE ASSOCIATED WITH CARBONATE-BEARING APATITES; by Sol R. Silverman, Ruth K. Fuyat, and Jeanne D. Weiser. Aug. 1951. 26p. (TEI-118)

TEI-144 1453
Geological Survey
HYDROTHERMAL URANOTHORITE IN FLUORITE BRECCIAS FROM THE BLUE JAY MINE, JAMESTOWN, BOULDER COUNTY; COLORADO; by George Phair and Kiyoko Onoda. Mar. 1951. 19p. (TEI-144)

TEI-151 1454
Geological Survey
SUMMARY OF THE RESEARCH WORK OF THE TRACE ELEMENTS SECTION, GEOCHEMISTRY AND PETROLOGY BRANCH; FOR THE PERIOD JANUARY 1–MARCH 31, 1951; by John C. Rabbitt. May 1951. 44p. (TEI-151)

TEI-182 1455
Geological Survey
SUMMARY OF THE RESEARCH WORK OF THE TRACE ELEMENTS SECTION, GEOCHEMISTRY AND PETROLOGY BRANCH, FOR THE PERIOD JULY 1 – SEPTEMBER 30, 1951; by John C. Rabbitt. [nd] 33p. (TEI-182)

TEM-9B 1456
Geological Survey
TREASURE HILL AREA, LARIMER COUNTY, COLORADO; by Donald G. Wyant. 6p. map. (TEM-9B)

TEM-146A 1457
Geological Survey
RESULTS OF DIAMOND DRILLING MERRY WIDOW CLAIM, WHITE SIGNAL, GRANT COUNTY, NEW MEXICO; by H. C. Granger and H. L. Bauer, Jr. 10p. maps. (TEM-146A)

TEM-251 1458
Geological Survey
RED AND GRAY CLAY UNDERLYING ORE-BEARING SANDSTONE OF THE MORRISON FORMATION IN WESTERN COLORADO; by Alice Dowse Weeks. May 1951. 19p. (TEM-251)

TEM-306 1459
Geological Survey
THEORY OF GAMMA-RAY LOGGING; PRELIMINARY CALCULATIONS; by A. Y. Sakakura. Dec. 1951. 11p. (TEM-306)

TPI-18 1536*
National Research Council of Canada
NUMBER OF FISSIONS INDUCED IN A THIN DISC OF FISSILE MATERIAL BY A UNIFORM DISTRIBUTION OF NEUTRONS; by P. R. Wallace. Issued Aug. 16, 1945. 9p. (TPI-18)

TPI-19 1537*
National Research Council of Canada
PRODUCTION OF NEUTRONS IN A THIN DISC DUE TO (α-n) REACTION IN BERYLLIUM; by P. R. Wallace. Issued Aug. 16, 1945. 4p. (TPI-19)

U12106 1486
Missouri Univ.
X-RAY ABSORPTION FACTORS FOR COATED CYLINDERS AND THEIR APPLICATION IN THE MEASUREMENT OF THIN FILMS, by Eugene B. Hensley. Sept. 1, 1950. 16p. (U12106; Technical Report No. 3)

U15284 1450
Oregon Univ.
POLAROGRAPHIC STUDY OF CORROSION PHENOMENA; FINAL REPORT; OCTOBER 1, 1946–OCTOBER 31, 1950; by Pierre Van Rysselberghe. Jan. 1951. 8p. (U15284)

GENERAL

RESEARCH PROGRAMS

1371
Office of Naval Research, London
SPECTROSCOPY AND NUCLEAR RESEARCH AT THE ZEEMAN LABORATORY, AMSTERDAM; by P. M. Marcus. Oct. 23, 1951. 6p. (ONRL-101-51; U61005)

A magnetic-lens-type β-ray spectrometer and a study of the decay scheme of I^{131} are discussed briefly. A small mass spectrometer used originally as a leak detector was used in an investigation of the water molecules in $CuSO_4 \cdot 5H_2O$. It was shown that an exchange of H atoms took place between the water molecules. Brief statements of research in progress on complex spectra, photoelectric effects in HgI_2, and microwave spectroscopy are included.

1372
Office of Naval Research, London
INSTITUTE FOR NUCLEAR PHYSICS AT HAMBURG; by P. M. Marcus. Oct. 24, 1951. 7p. (ONRL-102-51; U60852)

A visit made in August, 1951, is the basis for this undetailed outline of equipment, staff, and current research activities at the Institute for Nuclear Physics at Hamburg. A 2.5-Mev Van de Graaff accelerator is under construction; cosmic-ray observations are in progress; and electron scattering experiments with polarized electron beams are being attempted. Two mass spectrometers are in use, one applied to study of dissociation probability of various series of compounds. A thermal-diffusion column is being planned, and optical measurements on thin anisotropic films of alkalis are being made. No data are given.

BIOLOGY AND MEDICINE

1373
Brookhaven National Lab.
RODENT QUARTERS AIR CONDITIONING DESIGN CRITERIA, by John M. Ruddy. Dec. 13, 1951. 3p. (BNL-1055)

Minimum design criteria for year-round air conditioning are established as the most satisfactory health and breeding conditions for laboratory rats and mice.

1374
Brookhaven National Lab.
QUANTITATIVE OPTICAL TECHNIQUES IN THE STUDY OF NUCLEAR CHEMISTRY, by M. J. Moses. [nd] 38p. (BNL-1079)

The application of spectrophotometric methods to the quantitative chemical analysis of cells and cell structures is discussed critically, particularly as it concerns studies of the nucleus. Certain fundamental differences exist between the photometric analysis of solutions and of objects imaged through the microscope. Theoretical consideration of these differences as presented by Casperson ("Cell Growth and Cell Function," New York, W. W. Norton and Co., Inc., 1950) are summarized and discussed briefly, together with a description of his approach to the analysis of cells. The advantages of a more empirical approach are discussed in connection with the methods of relative cytophotometry in which concentrations and amounts are compared within similar structures. The uses, technical procedures, and errors in these methods are summarized and discussed. An apparatus for cytophotometric analysis, embodying several new features, is described. Some of the critical points involved in designing such an apparatus are also discussed.

RADIATION EFFECTS

1375
Chicago Univ.
LOCALIZATION OF X-RAY INJURY TO THE INITIAL PHASES OF ANTIBODY RESPONSE, by W. H. Taliaferro, L. G. Taliaferro and E. F. Janssen. [nd] 1p. (AECU-1846)

Hemolysin titers (50% units determined photometrically) were followed at frequent intervals in rabbits receiving total-body x irradiation of 600 or 700 r before or after a single injection of a standardized suspension of approximately 1.25 ml of 1% sheep red cells/kg rabbit. The administration of 700 r to rabbits during 1 week before the injection of red cells resulted in approximately doubling the induction period, decreasing the rate of the initial antibody rise, and reducing peak titer to about 1/7 that in nonirradiated controls. These effects disappeared after a month in that an essentially normal response was obtained in rabbits injected with red cells a month after irradiation. Similar irradiation of rabbits from 2 days to 2 hr after immunization also resulted in doubling the induction period, but it did not decrease the peak titer as compared to controls. The lengthening of the induction period in both affected groups and the occurrence of normal amounts of antibody in animals irradiated when the immunizing process had been in progress only 2 hr indicate that the damage of x irradiation to antibody formation is largely limited to the early phases of the immunizing process. (Entire report. Abstract of paper for N. Y. Meeting of American Association of Immunologists, April 1952.)

1376
Naval Medical Research Inst., Bethesda
PERMISSIBLE DOSAGE AND CONSIDERATIONS OF CALCULATED RISK; by C. F. Behrens. July 2, 1951. 21p. (NP-3546)

Pathological, hematological, and genetic effects of radiation are reviewed. Permissible limits are discussed from the standpoint of cumulative effects of minimal amounts over long periods of time, occasional exposures of patients in clinical radiology, the effects of an atomic bomb burst, continued effects from an atomic bomb due to contamination by fission products or resulting from induced radiation, exposures involved by purposeful contamination by radiological warfare agents, and exposures incidental to operation of nuclear reactors, more expecially when and if employed under conditions when adequate shielding may not be practicable. Calculated risk exposures are discussed and compared with permissible dosage ranges. Internal hazards from radioactive isotopes are discussed briefly. A table of permissible dosage determinations for both external and internal radiation exposures is included.

1377

Battelle Memorial Inst.

A BIBLIOGRAPHY ON "THE EFFECTS OF X-RAY ON BACTERIA" (1896–August 1951), by Radcliffe F. Robinson, Michael D. Phillips, and Margaret G. Nagelsen. Aug. 20, 1951. 18p. (NP-3610)

A list of 178 titles on the effects of x radiation on bacteria was compiled from abstract journals and indexes. Published articles from 1896 through August 1951 are included.

1378

Western Reserve Univ. School of Medicine

IN VIVO DIALYSIS OF BLOOD AS A MEANS OF INFLUENCING THE SURVIVAL OF X-IRRADIATED DOGS; by Paul S. Lavik, Jack R. Leonards, G. Warren Buckaloo, Charles Heisler, and Hymer L. Friedell. Dec. 15, 1951. 21p. (NYO-1637)

By means of an "artificial kidney," dogs given a lethal dose of x irradiation were subjected to an in vivo dialysis of their blood either during or at some time after the irradiation. No beneficial effects of the dialysis procedure were observed in the irradiated animals, even though the "artificial kidney" was shown to be highly efficient in removing a dialyzable substance from the extracellular fluid of dogs. While in vivo dialysis was not detrimental to nonirradiated controls or dogs dialyzed at the time of irradiation, sudden death occurred following dialysis in about 50% of the animals that had been irradiated 12 or more hours earlier. The latter effect of dialysis can be attributed to the removal of some essential factor(s) from the blood, for it could not be demonstrated in irradiated dogs subjected to a "sham-dialysis" procedure. Peritoneal lavage was without significant effect upon the survival of x-irradiated dogs. (auth)

1379

Atomic Energy Project, Western Reserve Univ.

MONTHLY PROGRESS REPORT NOV., 1951, by Hymer L. Friedell. [nd] 6p. (NYO-1639)

Distribution studies in normal and sub-total hepatectomized rats injected intravenously with colloidal Au^{198} showed a marked alteration of deposition and hematological response in the hepatectomized animals. These changes are discussed. Rats receiving colloidal Au^{198} prior to x irradiation showed approximately one-third of the x-ray effect after receiving pretreatment with cysteine.

1380

Atomic Energy Project, Univ. of Calif., Los Angeles

ATTEMPTS TO ALTER THE RESPONSE TO IONIZING RADIATIONS, by W. A. Selle. Issued Jan. 15, 1952. 53p. (UCLA-176)

A preliminary report reviewing literature dealing with attempts to alter the response of animals to ionizing radiations appeared in 1949 (NEPA Report 1127-IER-21). The present report summarizes approximately one hundred additional papers published since that time. Data, results and comments are presented in tabular form. In addition to various biological and pharmacological agents tested for their capacity to raise the tolerance of tissues to radiations, are included procedures which alter the physiological state by modification of the external and internal environment. The results and comments given are necessarily limited so that reference to the original article, given in the bibliography, may be necessary. The present report includes additional subjects not previously reviewed. Among these are the sulfhydryl group compounds, newer antibiotics, external and internal environmental factors, (body and environmental temperatures, oxygen tension, and general metabolism), cyanides and nitrides, splenic factors, and other miscellaneous subjects. 97 references. (auth)

1381

BIOLOGICAL EFFECTS OF SHORT WAVE RADIATIONS. INVESTIGATIONS ON INVERTEBRATES. Manfred Gersch and Wilfried Möbius. Strahlentherapie 85, 565-80(1951) (In German)

Radiation experiments were carried out on Enchytraeae (oligochaete worms) and the gnat larva Corethra. The oligochaetes were very resistant and showed no radiation injuries after administration of 90,000 r three times in succession. Corethra showed injuries to intestinal cells after being submitted to radiations of medium strength; higher doses resulted, in addition, in degeneration of pericardial cells (20 to 30 days after radiation) and of some thoracic cell complexes. Irradiation with 25,000 r caused great mortality and physiological injury to muscles, tracheal pigment cells, and the hypodermis. The cytological effects of radiation on the cells are described. It seems possible to use the pericardial cells as test cells whereby the action of short-wave radiations on the whole organism can be judged.

1382

FURTHER OBSERVATIONS ON INHIBITION OF LYMPHOID TUMOR DEVELOPMENT BY SHIELDING AND PARTIAL-BODY IRRADIATION OF MICE. Henry S. Kaplan and Mary B. Brown. J. Natl. Cancer Inst. 12, 427-35(1951) Oct.

Previous evidence that local irradiation is ineffective in the induction of mouse lymphoid tumors and that an indirect systemic mechanism must therefore be implicated was confirmed by partial-body irradiation and mediastinal shielding experiments. There was no evidence of an effect attributable to shielding or transplanted ovaries, while shielding of an indifferent area of the body such as the thigh significantly inhibits the genesis of lymphoid tumor.

1383

EXPERIMENTAL INVESTIGATIONS ON VITAMIN EFFECTS ON LIVER METABOLISM AFTER RADIATION INJURY. II. EFFECT OF LACTOFLAVIN AND PYRIDOXIN ON GLYCOGEN AND TOTAL NITROGEN OF THE LIVER IN TOTAL BODY IRRADIATED ANIMALS. Ruprecht Koch and Adam Bohländer. Strahlentherapie 85, 599-605(1951) (In German)

Mice were subjected to total-body x irradiations of 350 to 400 r each on 5 consecutive days, while 0.5 mg lactoflavin or 2.5 mg pyridoxin were given by subcutaneous injection 6 days before the first irradiation and after each irradiation except the last one. The animals were killed and investigated chemically several hours after the last irradiation. Irradiation did not change the N content of the liver, and vitamin treatment had no effect. The glycogen content of the liver dropped to 27% normal after irradiation; lactoflavin treatment decreased the loss of glycogen to 55% normal, and pyridoxin treatment decreased it to 51% normal.

RADIATION HAZARDS AND PROTECTION

1384

Chicago Univ.

THE TREATMENT OF POST-IRRADIATION INFECTION, by C. Phillip Miller, Carolyn W. Hammond, and Marianne Tompkins. [nd] 16p. (AECU-1816)

These experiments seem to demonstrate that generalized infection played a significant role in the death of mice exposed to moderate doses of total-body x radiation. Infection was caused by bacteria belonging to the intestinal flora. Treatment with antibiotics reduced the mortality to a significant degree; and, among the antibiotics tried, streptomycin was the most effective. Next in order of effectiveness were chloroamphenicol, aureomycin, and terramycin, among which there was no demonstrable difference in therapeutic value.

1385

PROTECTIVE ACTION OF METHYLAMINE AGAINST X-IRRADIATION. Z. M. Bacq and A. Herve. Nature 168, 1126(1951) Dec. 29.

Pure-bred C57 black mice 4 to 6 months old were irradiated with 250-kv x rays at the rate of 90 r/min following intraperitoneal injection of 2 mg of methylamine neutralized in water solution. Forty controls received either 700 or 850 r. All the mice irradiated with 700 r died between the 5th and the 10th day after irradiation; those which had received 850 r died between the 4th and the 8th day. In a group of 50 animals injected and irradiated with 700 r, the mortality (from the 5th to the 12th day) was small; 73% of the animals survived. The mice injected with methylamine and irradiated with 850 r died between the 4th and 11th day, later generally than the controls; only 7% survived. An injection of 2 or 2.5 mg of methylamine did not protect any animal against a dose of x rays greater than 850 r. A dose of 2 mg of methylamine injected 5 or 15 min after the end of irradiation (700 r) shifted the mortality curve slightly to the right.

1386

PROTECTIVE ACTION OF ETHYL ALCOHOL ON IRRADIATED MICE. Edith Paterson and Joyce J. Matthews. Nature 168, 1126-7(1951) Dec. 29.

Pure-bred "A" strain mice 6 to 8 weeks old were given two 1-ml doses orally of ethyl alcohol (10% by volume in saline) 80 and 20 min before a 700-r x irradiation. Mortality was 63% compared with 100% for controls. A rise in the LD_{50} radiation dose from 554 to 625 r and an extension of the life of nonsurvivors were noted with the alcohol treatment. No protection was obtained when the alcohol was given after the irradiation. The difference in protective value between 5 and 10% alcohol was not significant. Intravenous cysteine, 20 mg/mouse, gave greater protective effect than the alcohol in the doses used. Protection by alcohol was unrelated to its anesthetic effect. Intravenous nembutal, 1.3 mg/mouse, and intraperitoneal ethyl carbamate, 20 mg/mouse, did not change the LD_{50}.

TRACER APPLICATIONS

1387

Argonne National Lab.

CARBON 14 ISOTOPE EFFECTS IN BIOLOGICAL SYSTEMS; by Donald L. Buchanan and Akira Nakao. Nov. 1951. 17p. (AECU-1828; UAC-477)

A sealed balanced aquarium was prepared with C^{14}-labeled material and allowed to equilibrate for 3 years. Analyses for specific activity of a variety of samples from the aquarium showed small but significant variations between 4 species of plants and larger variations between organic and inorganic matter. Of all determinations made on material of recent growth the maximum difference (8%) was found to exist between snail shell carbonate and the terminal segments of aquatic plant leaves. These results are in accord with most of the published data on the differential behavior of the carbon isotopes in living matter. In a second experiment involving the isotope kinetics of a sealed culture of growing algae it was found that when growth began the specific activity of the plants was 6.5 ± 0.5 (standard error) % less than that of the inorganic carbon of the medium. As growth proceeded this difference in specific activity increased, but not as much as would be anticipated with the assumption of a completely irreversible transition of CO_2 to algal carbon. (auth)

1388

Brookhaven National Lab.

RED CELL POTASSIUM EXCHANGE IN SICKLE CELL ANEMIA, by D. C. Tosteson. Brookhaven National Lab. and College of Physicians and Surgeons, New York. [nd] 1p. (BNL-1086)

Previous work (D. C. Tosteson, Ethel Shea, and R. C. Darling, in press) revealed that red blood cells of patients with sickle cell anemia (SCA) lose potassium and gain sodium at roughly equal rates (meq/hr) upon de-oxygenation. K loss occurred at a rate of from 10 to 20 meq/1 RBC/hr during the first hour of de-oxygenation. During this period K loss could be reversed by re-oxygenating the red cells. That these disturbances in cation distribution are related primarily to the process of sickling was suggested by the following evidence: (1) Carbon monoxide, which prevents sickling, also blocked K loss and Na gain by de-oxygenated SCA red cells. (2) K loss could no longer be reversed by re-oxygenation when the SCA red cells became permanently sickled. Because of the rapidity of the cation shift described above, the rate of K exchange in SCA red cells was measured on samples of blood diluted with a K^{42}-tagged, glucose-enriched, bicarbonate-phosphate buffer incubated at 37°C. Aliquots of red cells, plasma, and whole blood taken at appropriate intervals were analyzed for radioactivity, K, and H_2O. Results indicated that K penetrates de-oxygenated SCA red cells as rapidly as it penetrates normal red cells. Since the SCA cells show net K loss under these conditions, the absolute outward rate of K movement must be greatly increased. (Entire report)

1389

Radiation Lab., Univ. of Calif.

THE LOCALIZATION OF CERTAIN ALKALINE AND RARE EARTH ELEMENTS IN THE COSTOCHONDRAL JUNCTION OF THE RAT; by C. W. Asling, J. G. Hamilton, Dorothy Axelrod-Heller, and Berniece Jue Louie. Dec. 18, 1951. 20p. (UCRL-1613)

Radioactive isotopes of Ca, Sr, Pm, Pu, and Am possessing a high degree of specific activity were administered by parenteral injection to adult rats. One and twenty-four hours following administration of these radioelements, animals were sacrificed and radioautographs prepared from histologic sections through the costochondral junctions. In this report only the one-hour data are given in the form of photomicrographs of the costochondral junction and its corresponding radioautograph. All five radioelements have apparently localized, in varying degrees, in both the bony and the cartilaginous segment of the rib at the end of the one-hour interval, though in the case of Am there is a question of its localization in the mineralized cartilaginous segment of the rib. Pm, Pu, and possibly Am were present in the periosteal extension of the rib cartilage. (auth)

CHEMISTRY

1390

Los Alamos Scientific Lab.

REACTIONS INVOLVING OPTICALLY ACTIVE STYRENE OXIDE; by F. Newton Hayes, Rodney H. Foss, and Betty S. Rogers. [nd] Decl. without deletions Jan. 14, 1952. 3p. (AECD-3293; LADC-1085)

The addition of HI to styrene oxide has been studied in order to elucidate the preponderance of α substitution in acid-catalyzed styrene oxide reactions. Optically active styrene oxide was synthesized by the partially asymmetric reduction of phenacyl bromide followed by treatment of the 1-phenyl-2-bromoethanol with KOH. Reaction of 2-phenyl-2-iodoethanol, formed by addition of HI to the styrene oxide, with pyridine gave 1-(1-phenyl-2-hydroxyethyl)-pyridinium iodide with $[\alpha]_D^{25} = +1.6°$. A salt identical in every respect but with $[\alpha]_D^{25} = -1.1°$ was synthesized from the same styrene oxide and pyridinium perchlorate by conversion of the perchlorate salt to iodide with NaI in acetone. Whereas the α carbon in styrene oxide undergoes two Walden inversions proceeding through the iodohydrin to the α-pyridinium salt of positive rotation, it goes through but one in forming the α-pyridinium salt of negative rotation in the pyridinium perchlorate reaction. Reaction of the styrene oxonium ion with pyridine proceeds at least 70% by a concerted route.

1391
Atomic Energy Research Establishment, Harwell, Berks (England)
THE FLOW OF IONS AND ELECTRONS THROUGH THIN ALUMINUM OXIDE FILMS; by A. Charlesby. 1951. 78p. (AERE M/R-714)

This report studies the growth of oxide layers on Al, and some of the electrical phenomena associated with the growth. Ultraviolet radiation is known to produce changes in oxide thickness on other metals, e.g., Ta, but in the case of Al the effect is very small. However, ultraviolet radiation does produce electrical changes in the film, and it is these changes which have been studied. To allow the greatest degree of control over the conditions of growth, electrolytic anodization is used. The main factors involved are the current through the film, the potential difference V applied, the film thickness δ, time, and temperature. The mean field F (= V/δ) is found to be an important factor determining film growth. The capacity C of the condenser formed by the insulating oxide layer between the metal and electrolyte is also considered, since it is a measure of film thickness. The total current i passing through the film is found to consist of the ion current i_+, which consists of Al^{+3} ions and builds up the film, and the electron current i_-, which has no appreciable permanent effect and appears to be associated with impurities or structural defects. (auth)

1392
New York Univ.
RESEARCH OF FLUORESCENCE AND CONDUCTIVITY PHENOMENA; SECOND QUARTERLY REPORT FOR MONTHS INCLUDING MAY, JUNE, JULY [1951]; by Hartmut Kallmann. Oct. 1951. 55p. (NP-3550; Progress Report [No.] 2; U20215)

Energy storage and release in inorganic phosphors. Experiments were continued on the fluorescence of alkali-halide crystals and ZnCd- and alkali earth-sulfide phosphors subjected to α and γ excitation with and without additional infrared irradiation. The energy storage of light-stimulated γ-dosed alkali-halide crystals decreased by factors of 0.6 and 3 within 1 day and 1 week, respectively, independent of dosage between 100 mr and 50 r and independent of irradiation rates between 0.5 and 50 r/hr. Light-photon emission after excitation by a single γ quantum extended over a considerable time without a strong initial peak. Strongly stimulable Fonda phosphors PIB, C, B, and F, and the B1 and Standard-VII phosphors showed a substantial light increase under α bombardment which was associated with the emptying of electron traps accompanied by light emission immediately after IR radiation was applied; further increases were observed with IR light applied after a 0.5-hr α irradiation. Excitation intensities were much smaller with γ radiation. Steady intensities under γ and IR irradiation were similar to those under γ irradiation alone but were less reproducible. The instantaneous fluorescent intensity of most powders irradiated with a 2-r/hr γ dosage increased slightly after the electron traps were filled by light illumination. Under α excitation and IR illumination, only Standard-VII and B1 powders gave steady light intensities larger than those without the IR; only Standard-VII behaved similarly under γ and IR irradiation. Conductivity measurements on ZnCdS powders. A method is outlined for obtaining a-c measurements of ZnCdS powders consisting of single grains with high contact resistances between them; the method appeared more promising than the d-c method. A combination of the methods involving a-c measurements with a superimposed d-c field yielded correlations of d-c data with dissipation factors and capacity changes. Coincidence method for investigating high-energy radiation: Based on a coincidence method which minimizes background effects in determining track origins, a triple-coincidence arrangement was developed to study the nature and energy of individual high-energy quanta in their path through scintillating liquids. Definite continuous tracks were obtained for solutions of terphenyl and diphenylhexatriene in xylene; track lengths appear to represent the intensities of the light flashes produced in each liquid. (cf. TIP U19981)

1393
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
CHEMISTRY OF THE FISSION ELEMENTS, COSMIC RAY, ELEMENTARY PARTICLE SCATTERING, AND M.I.T.-O.N.R. GENERATOR CONSTRUCTION AND HIGH VOLTAGE RESEARCH GROUPS, p.1-17 of PROGRESS REPORT; [AUGUST 31, 1951 TO NOVEMBER 30, 1951]. Nov. 30, 1951. 17p. (NP-3561(p.1-17))

The reaction between cupric chloride in absolute alcohol and basic substances has been investigated spectrophotometrically. The determination of ferric ion in various concentrations of HCl by measurement of the absorption at wavelengths shorter than 370 mμ is being studied. It has been demonstrated that the ratio of volumes of Hg and of the aqueous phase must be taken into account in determining the optimum potential at which to carry out an electrolytic separation using a Hg cathode. No data are given in the status report of Cosmic Ray Group. The interaction of synchrotron photons with protons in a hydrogen high-pressure chamber is being studied by analysis of tracks in nuclear emulsions. It has been found that the asymmetry in angular distribution of photofission fragments is much greater for 8-Mev photons than for 16-Mev photons. Factors affecting the performance of particle-acceleration tubes are being investigated. The use of SF_6 as sole gaseous insulating medium of Van de Graaff accelerators is being tried.

1394
New York Operations Office, AEC
TESTS ON THE CONTROL OF ETHER FIRES, by Edward J. Kehoe. July 1, 1951. 17p. (NYO-1561)

Report is made on the fighting of ether fires with carbon dioxide, low velocity water, fog, high velocity water fog, carbon tetrachloride, and dry chemical. It is concluded that dry chemical is the most effective of the agents tested for controlling incipient ether fires and it is recommended that dry chemical for such fires, special purpose type foam for large scale fires, and water fog or sprinklers for cooling be used. (auth)

1395
PREPARATION OF RADIOACTIVE SODIUM METAL BY EXCHANGE OF Na^{23} AND $Na^{22}Cl$. Norman H. Nachtrieb, John A. Weil, and Edward Catalano. J. Am. Chem. Soc. 74, 264(1952) Jan. 5.

Metallic radioactive Na has been prepared by the reaction $Na^{23}(l) + Na^{22}Cl(s) \rightarrow Na^{22}(l) + Na^{23}Cl(s)$. Essentially quantitative conversion was obtained when the Na/NaCl ratio was $\sim 10^4$. No effort was made to determine the distribution coefficient. The detailed nature of the reaction is not known. The high conversion rate rules out the possibility that the reaction involves only the contact surfaces. The NaCl may dissolve in the metal; alternatively, reaction may take place by diffusion of Na through NaCl.

1396

COMPOUNDS OF ZIRCONIUM AND HAFNIUM TETRACHLORIDES WITH ESTERS. W. S. Hummers, S. Y. Tyree, Jr., and S. Yolles. J. Am. Chem. Soc. 74, 139-41(1952) Jan. 5 (cf. NSA 5-3877, 5-3878)

$ZrCl_4$.2-ethyl benzoate, $ZrCl_4$.2-methyl benzoate, $ZrCl_4$.2-phenyl benzoate, $HfCl_4$.2-methyl benzoate, and $HfCl_4$.2-ethyl benzoate have been prepared and characterized. Heats of solution of $HfCl_4$, $ZrCl_4$, methyl benzoate, ethyl benzoate, phenyl benzoate, and the new compounds in nitrobenzene have been determined. The heats of formation of the new compounds have been determined. (auth)

1397

OBSERVATIONS ON SOME CHEMICAL AND PHYSICAL PROPERTIES OF TECHNETIUM AND ITS COMPOUNDS. Charles L. Rulfs and W. Wayne Meinke. J. Am. Chem. Soc. 74, 235-6(1952) Jan. 5.

The composition of Tc_2S_7 has been confirmed by analysis. Activity measurements on solutions prepared from this compound are in good agreement with recently reported precision values. The absorption spectrum of the pertechnetate ion has been examined. (auth)

1398

CRYOSCOPIC MEASUREMENTS IN FUSED SALTS AT ELEVATED TEMPERATURES. H. Flood, T. Førland, and A. Nesland. Acta Chem. Scand. 5, 1193-8(1951). (In English)

A method has been worked out which permits an accurate determination of the liquidus curve of phase diagrams at high temperatures. The method is based on a separation of a fraction of liquid from solid + liquid by filtration at the equilibrium temperature. The sulfate sides of the binary systems Na_2SO_4-NaCl and Na_2SO_4-NaBr have been investigated by this method. From these measurements, the heat of fusion of Na_2SO_4 is estimated to be 6100 cal, and the two systems are found to form ideal mixtures in the liquid state. (auth)

ANALYTICAL PROCEDURES

1399

Brookhaven National Lab.

ON THE DETERMINATION OF FRUCTOSE IN FRUCTOSE PHOSPHATE, by Leo Lutwak and Jacob Sacks. [nd] 3p. (BNL-1060)

In a determination of fructose-6-phosphate and fructose-1-6-diphosphate, it was determined that values for fructose varied from published data. It is suggested that the fructose equivalent of these preparations must be determined by each laboratory in order to establish the appropriate factor for use.

1400

Princeton Univ.

THE REDUCTION OF U(VI) TO U(IV) BY CADMIUM AMALGAM AND THE COULOMETRIC TITRATION OF U(IV) TO U(VI) BY ELECTROLYTICALLY GENERATED CERIC ION, by N. H. Furman, C. E. Bricker, and R. V. Dilts. Dec. 31, 1951. 5p. (NYO-793)

A solid Cd amalgam was prepared by boiling Hg, H_2SO_4, and Cd turnings until no more Cd would dissolve and stirring constantly during cooling. The product was packed tightly into a glass tube. The U sample to be determined was run through this reductor into a coulometric titration cell containing ferric ammonium sulfate and cerous sulfate. The ferrous ions created by oxidation of the U(IV) to U(VI) were titrated with electrically generated ceric ions. Quantities of U as small as 50 μg were determined within a maximum error of about 9%.

1401

Bureau of Mines, Bluemont, Va.

ANALYTICAL PROCEDURE FOR THE DETERMINATION OF THORIUM; by R. Kronstadt and Allan R. Eberle. Issued Jan. 1952. 8p. (RMO-838)

A rapid colorimetric method for the determination of Th in low-grade materials using La and Hg as gatherers and measuring the color intensity of the Th "thoron" complex is presented. With the sample in solution, the Th is chemically isolated by precipitations with ammonium hydroxide and oxalic acid using La for a carrier to separate it from most elements except the rare earths. The rare earths are separated by an iodate precipitation with Hg as carrier. Iodine is liberated by sodium nitrite and extracted with methyl ethyl ketone. An orange color is developed with "thoron" at a controlled acidity, and its intensity is compared with a standard, analyzed along with the sample, at a wave length of 545 mμ in the Beckman spectrophotometer. (auth)

1402

ON THE VOLUMETRIC DETERMINATION OF MOLYBDENUM. E. Gagliardi and W. Pilz. Monatsh. 82, 1012-21 (1951) Dec. 15. (In German)

Various methods of Mo determination reported in the literature are considered and found unsatisfactory. A manganometric method using a reductor-filter is described. About 15 min is required for a determination.

1403

FLUOROMETRIC MICRODETERMINATION OF URANIUM. V. THE URANIUM CONTENT OF SEA WATER. Masaki Nakanishi. Bull. Chem. Soc. Japan 24, 36-8(1951) Apr.

Ocean-water samples were analyzed for their U content by the fluorimetric method. Samples were taken at depths up to 4000 m. U content did not vary appreciably with depth except for a slight decrease at the surface. The values obtained in the deeper layers (average 2.8×10^{-6} g/liter) are somewhat higher than those obtained by other investigators.

1404

FLUOROMETRIC MICRODETERMINATION OF URANIUM. IV. MEASUREMENT OF THE FLUORESCENCE INTENSITY AND DETERMINATION OF THE URANIUM CONTENT IN NATURAL SUBSTANCES. Masaki Nakanishi. Bull. Chem. Soc. Japan 24, 33-6(1951) Apr.

Previous papers in this series have described the preparation of fluorescent beads by fusion of the U sample with NaF. In this paper two methods of measuring the intensity of the fluorescence of this bead (the photographic spectral-photometry method and the visual-observation method) are compared. Use of comparison beads in determining the U content of rocks is discussed.

1405

ULTRAVIOLET SPECTROPHOTOMETRIC DETERMINATION OF COLUMBIUM. George Telep and D. F. Boltz. Anal. Chem. 24, 163-5(1952) Jan.

An investigation was undertaken of conditions under which niobium can be determined spectrophotometrically as perniobic acid. Formation of the perniobic acid complex in a concentrated acidic mixture of sulfuric and phosphoric acids results in a stable yellow hue exhibiting maximum absorbency in the ultraviolet region. The system conforms to Beer's law at 342 mμ. The optimum concentration using 1-cm cells is from 0 to 125 ppm. of niobium. The effects of acid concentration, hydrogen peroxide concentration, and diverse ions were determined. The main interferences are due to ferric, molybdate, vanadate, titanic, tungstate, nitrate, chloride, and fluoride ions. The method is simple, rapid, and accurate. The ultraviolet spectrophotometric method for the determination of small amounts of niobium shows a marked increase in sensitivity over the colorimetric method.

1406

APPLICATION OF ION EXCHANGE TO DETERMINATION OF BORON. J. Robert Martin and John R. Hayes. Anal. Chem. 24, 182-5(1952) Jan.

Conventional methods for the determination of boron require a rather lengthy separation from interfering elements. In an effort to improve this, an attempt was made to substitute ion exchange for the usual distillation. The method developed employs a cation exchanger to separate boron from large amounts of cation-forming elements. The measurement of the boron content, accomplished by a modification of the familiar titrimetric procedure in the presence of invert sugar, permits the presence of moderate amounts of such anions as silicate, arsenate, molybdate, and phosphate. The method gives accuracy equal to or better than conventional procedures in the analysis of a variety of types of samples with boron contents ranging from 0.03 to 20.0%. An appreciable saving in time is possible. (auth)

1407

THE POLAROGRAPHIC DETERMINATION OF CHROMIUM IN CERTAIN ALUMINIUM ALLOYS. E. C. Mills and S. E. Hermon. Metallurgia 44, 327-30(1951) Dec.

A semimicro method for the determination of chromium in binary chromium-aluminum and certain aluminum alloys is described. When copper is present in amounts greater than about 0.25% a modified procedure is recommended. Normal constituents of the alloys tested do not interfere, nor do minor amounts of the elements more rarely present. The method has been used for chromium contents covering the range 0 1-0.5%, but this range could probably be extended. (auth)

1408

AN APPARATUS FOR THE WET COMBUSTION OF ORGANIC COMPOUNDS FOR C 14 ASSAY. Bengt Borgström. Acta Chem. Scand. 5, 1187-9(1951). (In English)

An apparatus similar to that of Claycomb et al. (Nucleonics 7, 38(1950)) is described for the wet combustion of organic compounds. Combustion takes place in van Slyke-Folch fluid in vacuum at 230°C in an oil bath for 1.5 hr, and the CO_2 formed is collected in $Ba(OH)_2$, the excess of which is titrated. A simple shaking device permitting a number of combustions to be run simultaneously is described.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1409

CRYSTAL STRUCTURE OF HEAVY METAL ORTHOVANADATES. W. O. Milligan and L. W. Vernon. J. Phys. Chem. 56, 145-8(1952) Jan.

The following is a brief summary of the results of this investigation: (1) The orthovanadates of Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, and Sc possess the zircon structure. (2) The oxygen parameters for fourteen of these orthovanadates are $x = 0.19 \pm 0.01$ and $z = 0.35 \pm 0.01$. For Sc orthovanadate the parameters are $x = 0.20 \pm 0.01$ and $z = 0.32 \pm 0.01$. (3) The oxygen tetrahedra in scandium orthovanadate are elongated in the direction of the c-axis. In the other orthovanadates of this series the oxygen tetrahedra are almost regular. (auth)

1410

THE GROWTH OF CADMIUM IODIDE CRYSTALS. I. DISLOCATIONS AND SPIRAL GROWTH. A. J. Forty. Phil. Mag. (7) 43, 72-81(1952) Jan.

Evidence is given that cadmium iodide crystals grow from a low degree of supersaturation by the dislocation mechanism. Sequences of photographs illustrate the stages in the growth of the crystal plates. The screw dislocations are not simple but are groups of simple dislocations. The kinking of step-lines is explained by the interaction of screw dislocation groups of different strengths. The properties of large screw dislocation groups in the crystal plates are discussed. (auth)

FLUORINE AND FLUORINE COMPOUNDS

1411

THE INFRARED SPECTRUM OF DISULFUR DECAFLUORIDE. D. Edelson. J. Am. Chem. Soc. 74, 262(1952) Jan. 5.

The infrared absorption spectrum of S_2F_{10} from 2.5 to 22 μ (500 to 2000 cm^{-1}) is shown, and bands and their intensities are tabulated. By comparison with the spectrum of SF_6, some vibration frequencies are assigned tentatively.

1412

THE SOLUBILITY OF POLYTRIFLUOROCHLOROETHYLENE. H. Tracy Hall. J. Am. Chem. Soc. 74, 68-71(1952) Jan. 5.

A physico-chemical study of the solubility of the semicrystalline polymer of trifluorochloroethylene has been made. Curves are given from which it is possible to determine whether a particular liquid will be a solvent and if so the solution temperature. The information necessary for the utilization of these curves is (a) the solubility parameter of the liquid at 25°C, (b) the molar volume of the liquid at 25°C and (c) the coefficient of cubical expansion of the liquid. Several thermodynamic constants have been determined from solubility and crystal melting temperature data for this polymer among which are the heat of fusion of the crystallites (18.1 cal/g), the solubility parameter of the amorphous polymer ($\delta_p^T = 8.05\ e^{-0.000925T}$, where T is in °C), and the interaction parameter μ for various polymer-solvent systems. For this particular polymer the interaction parameter μ_s is given by the expression $\mu_s = V_{r.u.}/V_0^{T_s}$, where $V_{r.u.}$ is the volume of the repeating unit in the amorphous polymer and $V_0^{T_s}$ is the molar volume of the solvent at the solution temperature T_s. (auth)

1413

MELTING TEMPERATURE AND POLYMER-SOLVENT INTERACTION: POLYCHLOROTRIFLUOROETHYLENE. A. M. Bueche. J. Am. Chem. Soc. 74, 65-7(1952) Jan. 5.

The melting temperatures of polychlorotrifluoroethylene-diluent mixtures have been measured. The results, when compared with the theory for the phenomenon, are shown to give consistent values for the heat of fusion and the solubility parameter of the polymer. The Flory-Huggins theory of polymer solutions was used to explain the results for higher diluent concentrations, where a two-phase system existed. The interaction parameters, μ, from this theory, have been assigned approximate values. (auth)

GRAPHITE

1414

Argonne National Lab.

LATTICE VIBRATIONS IN GRAPHITE, by R. Gurney. [nd] Decl. Jan. 24, 1952. 3p. (AECD-3243(Rev.))

The frequency spectrum of the graphite lattice is discussed. The usual Debye expressions defining the frequency spectrum are replaced by two-dimensional expressions because at very low temperatures only transverse waves with direction of propagation within the crystal planes and with displacements perpendicular to these planes will be excited. The only other vibrations which have weak restoring forces are longitudinal waves propagated perpendicular to the planes; if the crystallite units are only from 12 to 17 atoms thick, no waves of long wavelength will be associated with these longitudinal waves. The usual T^3 law for the specific heat at low temperatures is replaced by $C_v = 9.6RT^2/\theta^2$. The expression is compared with experimental values for the specific heat of graphite, and modified Debye curves are shown.

415

Argonne National Lab.
THE PROPERTIES OF THE INTERSTITIAL COMPOUNDS OF GRAPHITE; III. THE ELECTRICAL PROPERTIES OF THE HALOGEN COMPOUNDS OF GRAPHITE; by Gerhart Hennig. Nov. 21, 1951. 16p. (ANL-4723)

The presence of lamellar or of residual bromine in artificial graphite reduces the resistance, the absolute magnitude of its temperature coefficient near room temperature, and the magneto resistance. The Hall coefficient increases and eventually changes from negative to positive values. The changes resemble very closely those obtained in the oxidation of graphite in sulfuric acid. This similarity in properties suggests that the electron acceptors in these compounds are only weak scattering centers for conduction electrons. Since the electrical properties of graphite bisulfate and of graphite bromide are very similar, it may be assumed that both compounds are of a similar type. Since the bisulfate compound is ionic in nature, the bromine in graphite bromide is also probably ionized. On this assumption the graphite bromides have the formulae $C_n\ Br.3Br_2$ for the lamellar and $C_n\ Br.2.25Br_2$ for the residue compounds. Chlorine reacts with graphite at low temperatures only. The properties of the compounds of chlorine and graphite resemble in all respects those of the compounds of bromine and graphite. Attempts to react iodine and graphite have failed. Iodine chloride, however, reacts rapidly with graphite. (auth)

LABORATORIES AND EQUIPMENT

1416

National Research Council of Canada. Div. of Building Research
REPORT ON SPACE REQUIREMENTS FOR SCIENTIFIC RESEARCH LABORATORIES; by J. Lorne Gray. Jan. 1949. 10p. (NRC-1913; Technical Report No. 3)

MOLECULAR STRUCTURE

1417

SUM RULES FOR THE VIBRATION FREQUENCIES OF ISOTOPIC MOLECULES. J. C. Decius and E. Bright Wilson, Jr. J. Chem. Phys. 19, 1409-12(1951) Nov.

The squares of the frequencies of isotopically related molecules obey certain simple sum rules. Whenever there exists a chemical exchange reaction involving only isotopic variations of a single type of molecule, such that the reaction is balanced at each atomic position of the molecule, then a relation of identical form exists between the sums of the squares of the frequencies. Thus

$$\Sigma\nu^2(H_2O) + \Sigma\nu^2(D_2O) = 2\Sigma\nu^2(HDO)$$
$$\Sigma\nu^2(N^{14}H_3) + \Sigma\nu^2(N^{15}D_3) = \Sigma\nu^2(N^{14}D_3) + \Sigma\nu^2(N^{15}H_3)$$

If, as in the latter example, the molecules all have the same symmetry, the sum rule may be applied separately to each factor of the secular equation. When forms of lower symmetry appear (as in the example involving the water molecule), symmetry factoring may or may not be possible. In such cases it is necessary to employ certain group-theoretical considerations; the possible factoring is not in general identical with that appropriate for the product rule. Examples of the application of the sum rule are given, involving the acetylene, water, methane, and hydrocyanic acid molecules. The existence of higher order isotope rules, intermediate between the sum and product rules, is pointed out. (auth)

1418

A POSSIBLE RELATION BETWEEN THE NUCLEAR RELAXATION TIME, T_2, AND MOLECULAR STRUCTURE. C. S. Clay, R. S. Bradford, and Ellis Strick. J. Chem. Phys. 19, 1429(1951) Nov.

The relaxation time, T_2, occurring in transient solutions of the Bloch equations can be used as a measure of the spread of magnetic fields at the hydrogens of hydrocarbon molecules and is strongly related to the molecular symmetry. Results of measurements of T_2 are listed for methyl-substituted propane, butanes, and pentanes which support this relationship.

RADIATION EFFECTS

1419

COLOR CENTERS IN GLASS. R. K. Sheline, D. E. Sharp, and W. J. Arner. J. Chem. Phys. 19, 1422-3(1951) Nov.

Changes in luminescence and absorption spectra with heating of a borosilicate glass colored by exposure to Ra radiations for 28 yr are described. The observations are attributed to the presence of color centers in the glass.

1420

RECOIL REACTIONS WITH HIGH INTENSITY SLOW NEUTRON SOURCES. I. THE SZILARD-CHALMERS ENRICHMENT OF 35.9 h Br^{82}. G. E. Boyd, J. W. Cobble, and Sol Wexler. J. Am. Chem. Soc. 74, 237-40(1952) Jan. 5.

Enriched 35.9-hr Br^{82} samples from a Szilard-Chalmers reaction in crystalline $KBrO_3$ (in the Oak Ridge graphite pile) showed specific activities up to 750 rd/mg, corresponding to a 22,000-fold enrichment. The variation of the specific activity with irradiation time and neutron source intensity agreed with an elementary theory based on the activation equation and the assumption that the rate of the non-activating radiation decomposition was proportional to the mass irradiated and to the intensity. The prediction that the specific activity will be independent of the source intensity and will decrease with increasing time was confirmed as was the predicted inverse dependence of the enrichment on source strength and time. The retention of radiobromine as bromate was found to increase with time, suggesting a radiation recombination may occur. (auth)

1421

THE CHEMICAL EFFECTS OF α-PARTICLES UPON SOME C_6-HYDROCARBONS IN THE VAPOR STATE. Victor P. Henri, Charles R. Maxwell, William C. White, and Dorothy C. Peterson, J. Phys. Chem. 56, 153-5(1952) Jan.

Some of the chemical effects of α-particles upon n-hexane, cyclohexane, cyclohexene, and benzene have been determined. The hydrocarbons were mixed in the vapor state with radon and allowed to stand for several weeks. The resulting gaseous mixtures were analyzed by the use of a mass spectrometer. Some of the physical properties of the liquids formed in each case were also determined. (auth)

SEPARATION PROCEDURES

1422

Argonne National Lab.
Excerpts from THE METABOLISM OF CARRIER-FREE FISSION PRODUCTS IN THE RAT, by K. G. Scott, R. Overstreet, L. Jacobson, J. G. Hamilton, H. Fisher, J. Crowley, I. L. Chaikoff, C. Entenman, M. Fishler, A. J. Barber, and F. Loomis. [nd] Decl. with deletions Jan. 25, 1952. 19p. (AECD-3296; ADF-494)

Procedures for the preparation of carrier-free Ba^{140}, Sr^{89}, La^{140}, Ce^{140}, Pr^{143}, Zr^{93}, Nb^{93}, Ru^{105}, Te^{127}, Te^{129}, Cs^{134}, and Cs^{135} are discussed in detail.

1423

Atomic Energy Research Establishment, Harwell, Berks (England)

ELECTROSTATIC SEPARATION OF MINERALS; A BIBLIOGRAPHY OF PUBLISHED PAPERS. Dec. 1951. 4p. (AERE Inf./Bib.-80)

This bibliography on electrostatic separation of minerals has been compiled mainly from Chemical Abstracts from 1907 to 1951. Article source and abstract journal references are given. The bibliography is not annotated.

1424

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

NUCLEAR CHEMISTRY (INORGANIC) GROUP, p.18-38 of PROGRESS REPORT; [AUGUST 31, 1951 TO NOVEMBER 30, 1951]. Nov. 30, 1951. 11p. (NP-3561(p.18-38))

The scintillation-counting properties of a group of crystalline organic compounds have been studied; decay time, pulse heights, and fluorescence spectra are tabulated. The suitability of ion-exchange membranes as electrophoretic media is discussed; the migration of a lamina traced with 2.6-yr Na^{22} in an ion-exchange membrane in the Na form which was electrolyzed between Zn electrodes was traced by autoradiography. The distribution of nuclear charge in U fission and the probability of neutron emission from fission products are briefly considered. A rapid method of separation of Mo and Tc from other fission products and from each other is outlined. Yields of nine nuclides in the photofission of U are tabulated. Rough estimation of the thermal-neutron-fission yield of the 9-hr Rh species indicates a mass number of 107 for it. From analysis of Nd and Pm activities resulting from neutron irradiation of Nd_2O_3 it appears that Pm^{151} has a half life of ~25 hr and Pm^{149} > 60 hr. Relative yields of isomers of Se^{81} and of Te^{131} from (d,p) reactions have been determined. Using radioactive Ga tracer the distribution coefficient of Ga(III) between hydrochloric acid and β,β'-dichlorodiethyl ether has been measured over an acid concentration range of 2.2 to 11.7M. Discontinuities in neutron and proton binding energies at shell populations of 28, 50, 82, and 126 have been computed from empirically identified shifts in the well-defined Z_A curves.

SORPTION PHENOMENA

1425

Amherst Coll.

HEAT OF ADSORPTION ON CARBON ADSORBENTS; NITROGEN, ARGON AT −195°C AND METHANOL AT 0°C; 1 DECEMBER 1948 TO 1 APRIL 1950; by R. A. Beebe, B. Millard, and J. Cynarski. [nd] 36p. (NP-3556; Technical Report No. 1; U15754)

Differential heats of adsorption were calorimetrically measured for processes involving C surfaces of varying physical characteristics. N and A were used as adsorbate gases at −195°C and MeOH at 0°C. The C adsorbents studied include 2 C blocks (Spheron and Graphon), wear-dust samples, and 2 Saran charcoals of high adsorptive capacity. Differences in the differential-heat curves on nonporous adsorbents indicated a relationship with the degree of heterogeneity of the surface. Curves for A on Spheron and Graphon suggested a heterogeneous surface for the former and a more homogeneous surface resembling graphite with a higher specific-surface area for the latter. A-on-Graphon curves exhibited a repeating maximum near the completion of the first 3 successive layers; the maximum was attributed to lateral interaction as the layers were filled. Heat measurements with N and A on the Saran-S600H charcoal gave higher values than those obtained on the nonporous C blacks in the entire adsorption range from a bare surface to saturation. This effect was probably due to the cooperative effect of adjacent adsorbing walls. Lower curves for N and A on Saran S84, a charcoal of higher adsorptive capacity but lower pore size, indicated a lower cooperative effect. The wear-dust C surfaces were less homogeneous than predicted. Heats for MeOH on Graphon gave an isotherm similar to graphite and were positive even for early increments; results were consistent with observations for the elementary gas adsorbates.

1426

Institute for the Study of Rate Processes, Univ. of Utah

A SIMPLIFIED METHOD FOR DETERMINING SURFACE AREAS OF POROUS SOLIDS; by Wendell H. Wiser, V. Dean Allred, and Melvin A. Cook. June 1, 1951. 9p. (NP-3562; Technical report No. VI; U20310)

The method developed for determining the surface areas of finely divided or porous solids is based on the physical adsorption of H_2O vapor at temperatures near 100°C and at atmospheric pressure. Type II gas adsorption isotherms were obtained for Hopcalite samples which had been degassed by having dry carrier gas passed over them at the temperature of the adsorption run. The sample attached to a chainomatic-type balance required no elaborate vacuum system. Results were reproducible and agreed with those resulting from the BET method (J. Am. Chem. Soc. 60, 309 (1938)). (NRS Abst.)

SPECTROSCOPY

1427

Argonne National Lab.

α- AND β-BANDS IN POTASSIUM BROMIDE CRYSTALS, by Charles Delbecq, Peter Pringsheim, and Philip Yuster. Jan. 1952. 4p. (AECU-1844; UAC-497)

A KBr crystal colored by exposure to x rays at liquid N_2 temperature showed in its absorption spectrum the F band at 600 mμ, the α band at 203 mμ, and the β band at 193 mμ, whereas a crystal colored at room temperature showed only the F and β bands. These two absorption bands which occur below 210 mμ in KBr are analogous to the α and β bands observed previously in KI due to negative ion vacancies and F centers, respectively. These observations are discussed in relation to the observations of other investigators.

1428

Argonne National Lab.

MODIFICATIONS OF THE ABSORPTION SPECTRA OF ANIONS INDUCED BY COMPLEX FORMATION, by Leonard I. Katzin. Dec. 3, 1951. 10p. (AECU-1849; UAC-495)

An abstract of this report was indexed as AECU-1369 and appears in Nuclear Science Abstracts as NSA 5-4719.

SYNTHESES

1429

National Bureau of Standards

FLUORINE SUBSTITUTION IN HYDROUS SILICATES AND RELATED MINERALS; by A. Van Valkenburg and R. Pike. Dec. 10, 1951. 4p. (NBS-1355)

Progress is reported in an investigation to determine the basic conditions necessary for the artificial crystallization of useful silicates and other high-temperature inorganic compounds. Substitution of F^- for $(OH)^-$ groups in silicate structures was investigated, and the synthesis of anhydrous norbergite, $(MgF_2)Mg_2SiO_4$, and chondrodite, $(MgF_2)2Mg_2SiO_4$, in which all the $(OH)^-$ were replaced by F, is reported.

1430

National Bureau of Standards

SYNTHESIS OF D-GLUCOSE-1-C^{14} AND D-MANNOSE-1-

C^{14}; by H. S. Isbell, J. V. Karabinos, H. L. Frush, N. B. Holt, and A. Schwebel. Dec. 31, 1951. 43p. (NBS-1368)

Procedures for production of D-mannose-1-C^{14} by condensation of D-arabinose with $NaC^{14}N$, $NaHCO_3$, and CO_2 and of D-glucose-1-C^{14} by condensation with $NaC^{14}N$ and either $CaCl_2$ or Na_2CO_3 are presented. D-mannonomo-γ-lactone-1-C^{14}, Ba D-gluconate-1-C^{14}, and D-glucono-Δ-lactone-1-C^{14} occur as intermediates.

1431

Columbia Univ.

UTILIZATION OF WASTE FISSION PRODUCTS IN CHEMICAL REACTION, by W. A. Selke, C. Kardys, E. V. Sherry, and R. C. Jagel. Jan. 1, 1952. 7p. (NYO-3327)

The synthesis of ammonia in a gamma radiation field produced by a Co^{60} source has been studied. The runs made to date have been uncatalyzed batch irradiations at one atmosphere pressure. Variables employed were dose time, nitrogen-hydrogen ratio, temperature, and area of glass surface in contact with the reaction mixture. Yields in this early stage are in the order of $10^{-4}\%$, but definite advantage is shown in use of hydrogen-rich feed mixture and extended glass surface. (auth)

TRACER APPLICATIONS

1432

Mound Lab.

DETERMINATION OF TRACERS IN THE PRESENCE OF THEIR RADIOACTIVE DAUGHTERS; by H. W. Kirby. Oct. 3, 1951. 6p. (MLM-639)

Equations are presented for determining what proportion of the measured radioactivity is due to each nuclide where mixtures of genetically related isotopes are employed as tracers to follow a chemical reaction, and where the particles emitted by parent and daughter are of the same kind.

URANIUM AND URANIUM COMPOUNDS

1433

Massachusetts Inst. of Tech.

THE MAGNETIC SUSCEPTIBILITY OF URANIUM AND SOME URANIUM ALLOYS WITH MANGANESE, IRON, COBALT AND NICKEL (thesis); by Paul Gordon. [nd] 172p. (AECU-1833)

Equipment for the vacuum melting and homogenizing of alloys and apparatus for the measurement over a range of temperatures of magnetic susceptibilities by the Curie method have been designed and constructed. Binary alloys of U with elements Cr, Mn, Fe, Co, and Ni of the iron transition group have been prepared. The susceptibilities of these alloys and that of pure U have been measured as a function of temperature. The materials were found to exhibit several types of temperature dependence, and one of the alloys, UFe_2, was discovered to be ferromagnetic at temperatures well below atmospheric. The results obtained are discussed in the light of theoretical considerations in the literature on magnetism. 46 figures. (auth)

1434

ON THE COMPLEX CHEMISTRY OF THE URANYL ION. V. THE COMPLEXITY OF URANYL SULFATE. Sten Ahrland. Acta Chem. Scand. 5, 1151-67(1951). (In English)

Potentiometric and extinctiometric (at 3100 A) studies of the complexes of uranyl sulfate in aqueous solution at 20°C are reported. Association constants obtained by the two methods are in good agreement.

1435

ON THE OXIDATION OF METALLIC URANIUM. Jean Loriers. Compt. rend. 234, 91-3(1952) Jan. 2. (In French)

The oxidation of U in O_2 has been studied by differential thermal analysis from 100 to 360°C. The mechanism is similar to that of Ce oxidation. The initial homogeneous protective oxide layer thickens and breaks up in such a way that the mass-time curve of oxidation changes from a parabolic to a linear type. The nature of the oxides involved is discussed.

WASTE DISPOSAL

1436

Knolls Atomic Power Lab.

DISPOSAL OF RADIOACTIVE LIQUID AND SOLID WASTES, by Robert H. Simon. Dec. 28, 1951. 18p. (AECU-1837)

The treatment and disposal of liquid and solid wastes from the laboratories, shops, and pilot plants at the Knolls Atomic Power Laboratory are discussed. Main projects of this laboratory are reactor development and study of chemical-separation processes. Because of the heavily populated area near the laboratory no detectable activity is allowed to be discharged to the ground water or to the river, and no final disposition of radioactive wastes is practiced at this site. After treatment, liquid effluent is potable from the standpoint of radioactive content. Diagrams of equipment and flowsheets of processes are included.

ENGINEERING

1437

Building Materials Research Lab., Mass. Inst. of Tech.

REPORT ON THE DEVELOPMENT OF HIGH DENSITY, HOMOGENEOUS CONCRETE USING PRESSURE GROUTING AND OTHER METHODS; by James A. Murray and John H. Cullinan. May 1, 1951. 89p. (AECU-1835)

Production of high-density concrete, preferably by the pressure-grouting method, and determination of the properties of concretes so produced were studied. A large number of auxiliary tests were made to determine the limitations of other methods and of materials, and data are presented. Concretes were made by the pressure-grouting method with densities from 150 to 385 lb/ft^3. The most practical of the concretes appeared to be that made with barytes gravel as coarse aggregate and a grout using fine Fe shot as fine aggregate. Such a concrete was made with a density of 260 lb/ft^3. It is estimated that with additional studies of grout pumpability as affected by gradation of shot, an increase of 10 to 15 lb/ft^3 may be effected. Concretes having densities of about 260 to 270 lb and placeable by conventional methods were made. These concretes appeared to lack cohesion but when placed with a minimum amount of internal vibration appeared to have adequate cohesion. The material cost of concretes with density of 260 to 270 lb/ft^3 placed by pressure grouting were estimated at about $160 per cu yd. A concrete weighing 385 lb/ft^3 was made by using metallic coarse aggregate.

1438

QUANTITATIVE EVALUATION OF ROCKET PROPELLANTS S. S. Penner. Am. J. Phys. 20, 26-9(1952) Jan.

A method for the quantitative evaluation of chemicals as rocket propellants is described. The procedure utilizes the fact that adiabatic expansion through a nozzle may be considered to be isentropic. Treatments are presented for the two limiting conditions of expansion, corresponding to flow without chemical change and to flow which is characterized, at all times, by the existence of thermodynamic equilibrium. (auth)

AEROSOLS

1439

Illinois Univ. Engineering Experiment Station

COLLECTION OF AEROSOL PARTICLES BY ATOMIZED

SPRAYS, by R. B. Feild. Oct. 31, 1951. (SO-1006; Technical Report No. 5)

The collection of aerosol particles by atomized water droplets in a venturi scrubber was studied. The use of dimensionless parameters to characterize the various methods of particle collection showed that inertial impaction was the most important mechanism in the systems studied. Ammonium sulfite and ammonium chloride fumes and dibutylphthalate smoke with volume-surface mean diameters of 1.22, 0.27, and 0.58 μ, respectively, were studied. The collection efficiencies obtained for the aerosols were correlated successfully on the basis of inertial impaction collection. As the dibutylphthalate aerosol collection could be correlated with the ammonium salt aerosols on the basis of the inertial mechanism of collection, it was concluded that the solubility of the aerosol is essentially immaterial in the performance of the venturi scrubber.(auth)

HEAT TRANSFER AND FLUID FLOW

1440

Tennessee Univ.

NATURE OF LIQUID FLOW WITHIN A SPHERICAL CONTAINER; SECOND QUARTERLY REPORT; by H. J. Garber and F. N. Peebles. Dec. 15, 1951. 48p. (AECU-1824)

A theoretical and experimental investigation of liquid flow within a spherical container is in progress. Specific information presented includes the following: (1) theoretical expressions for the tangential, radial, and vertical velocity component distribution for a spherical vessel with a tangential inlet pipe (or pipes) and two axial outlet pipes; (2) a theoretical expression for the static pressure distribution within the spherical vessel; (3) plots of mathematical functions which are convenient in the use of the theoretical relations; (4) results of experimental measurements of static pressure distribution in an 8.0-in.-ID sphere using both one and two inlet pipes; (5) an analysis of the experimental pressure-distribution data in terms of the theoretical equations, which indicated that the ratio of the total liquid flow rate to the eddy viscosity was a constant for the experimental conditions employed and that the effective value of the tangential velocity component at the sphere equator was directly proportional to total flow rate and liquid velocity in the inlet pipe or pipes; (6) results from the pressure-distribution data which supported the information previously reported (AECU-1826) that the pressure loss is proportional to the square of the total liquid flow rate and that the pressure loss in a sphere with a single inlet pipe is greater than that in a sphere with two inlets by a factor of ~2 for a constant liquid flow rate.

1441

Tennessee Univ.

NATURE OF LIQUID FLOW WITHIN A SPHERICAL CONTAINER; FIRST QUARTERLY REPORT; by H. J. Garber and F. N. Peebles. Sept. 15, 1951. 7p. (AECU-1826)

An investigation concerning the nature of liquid flow in a spherical container has been initiated. Problems to be studied are listed, and a brief bibliography of the literature dealing with related subjects is given. The pressure-drop characteristics of glass spheres with two tangential inlets and two axial outlets have been determined as a function of flow rate. For a given sphere and flow arrangement, the pressure drop increased directly with the square of the total flow rate. For a given sphere and a given flow rate, the pressure drop using a single inlet was greater than that using two inlets by a factor of 2. For a given sphere and a given flow rate, little variation in the pressure drop was noted as the number of outlets in use was varied.

1442

Hanford Works

ON THE EDDY DIFFUSION OF A CONTAMINANT EMITTED CONTINUOUSLY FROM A SINGLE SOURCE; by G. R. Hilst. Dec. 7, 1951. 21p. (HW-22942)

A kinematic analysis of the process of eddy diffusion is outlined and discussed. Certain parameters of turbulent fluid motion which appear to be directly related to the rate of growth or diffusion of a contaminant plume emitted continuously from a single source are derived. Since these parameters do not depend upon other indirect parameters of turbulent flow, such as local gustiness or fluid stability, they may be of considerable practical usefulness. The results of this study are not subject to experimental verification at the present time since a special instrument capable of continuously measuring any desired component of the fluid flow is required. (auth)

1443

Massachusetts Inst. of Tech.

CONSTRUCTION AND OPERATION OF APPARATUS FOR STUDY OF HEAT TRANSFER WITH SURFACE BOILING; by Warren M. Rohsenow, Edward H. Somna, and Paul V. Osborn. July 1, 1950. 63p. (NP-3543; Technical Report No. 2; U60506)

A detailed description is given of test apparatus designed and constructed to study the effects of surface boiling on heat transfer to water flowing in a tube under the following conditions: water pressures up to 2000 psia, water velocities up to 40 ft/sec, and water bulk temperatures up to 550°F. The apparatus is a closed system consisting of a vertical test section of pure Ni, a Hayward-Tyler centrifugal pump, a calibrated orifice, a heat exchanger, and a pressure vessel. A discussion is given of operating techniques, data measurements, and calculating procedure, with derivations of formulas, calibration of instruments, and other experimental determinations. A series of photographs which record the dismantling of the Hayward-Tyler centrifugal pump for cleaning is presented. They indicate very clearly the source of the contamination which has led to a continual deposition of scale on the inside of the test section, apparently due to an electroplating of ferric ions. Cleaning of this scale has proved to be exceedingly time consuming, and an ion exchange to trap the objectionable ions is to be added to the circuit.

1444

THERMAL CONDUCTIVITY OF LIQUID SODIUM AND POTASSIUM. C. T. Ewing, J. A. Grand, and R. R. Miller. J. Am. Chem. Soc. 74, 11-14(1952) Jan. 5.

Conductivity coefficients were measured for liquid Na and K metals with a longitudinal heat flow apparatus—sodium to 510°C and potassium to 610°C. A description of an apparatus for accurate measurement of high-boiling metals to 600°C is presented. The ideality of the pure liquid-metal media is shown by the conformation of the conductivity values to empirical and theoretical postulations. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

1445

Knolls Atomic Power Lab.

A WINDOW SHIELD FOR VACUUM MELTING OPERATIONS, by Robert V. Gray. [nd] 4p. (AECU-1836)

The most common method of temperature measurement for vacuum melting is by sighting an optical pyrometer, through a window on the furnace top, upon the hot metal inside. The window is often protected by a metal shield which can be moved aside when readings are taken. However, this procedure presents one difficulty which can cause a large error in the actual temperature measurement; the vaporization of the molten metal and its deposition on the inside surface of the window. To the operator taking regular readings this gradual clouding of the glass can happen imperceptibly. To overcome this problem a new shield was designed. This device consists of a rotatable disk containing several auxiliary windows in its periphery. As each auxiliary window becomes coated with metallic deposits, the disk is rotated to expose a new window by means of the shaft which extends through the furnace wall.

1446

North Carolina State Coll.

THE MEASUREMENT OF THERMAL PROPERTIES OF NON-METALLIC MATERIALS AT HIGH TEMPERATURES; PROGRESS REPORT NO. 2, COVERING PERIOD OCTOBER 1, 1951–DECEMBER 31, 1951, by K. O. Beatty, Jr. Jan. 15, 1952. 5p. (AECU-1840; Progress Report No. 2)

A scale model of a proposed furnace was built to test platens, insulation, and general operating behavior. No experimental data are included.

CERAMICS AND REFRACTORIES

1447

NEPA Div., Fairchild Engine and Airplane Corp.

ALUMINA, by Helen M. Lee. June 27, 1950. 103p. (NEPA-1262)

All available data are compiled and correlated on properties, fabrication, preparation, and analysis of alumina and on equilibrium studies with other elements and compounds. A bibliography with 69 references is appended.

1448

Massachusetts Inst. of Tech.

THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS; TECHNICAL PROGRESS REPORT; by F. H. Norton and W. D. Kingery. Jan. 1, 1952. 34p. (NYO-601)

The thermal conductivities of Th oxide, Zr oxide, and an electrical Porcelain for temperatures up to 1300°C are presented graphically. A comparative method and equipment for measuring thermal conductivity of ceramic materials are described. The thermal conductivity of Al_2O_3 has been determined at temperatures up to 1750°C by an ellipsoidal test method employing induction heating. Tabular data on the above, a discussion of the theory of power measurement for induction heating, and a literature survey on the effect of porosity on thermal conductivity are included in appendixes.

1449

Massachusetts Inst. of Tech.

STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES; TECHNICAL PROGRESS REPORT; by F. H. Norton and W. D. Kingery. Jan. 1, 1952. 23p. (NYO-3137)

The nature and extent of reactions at the interfaces of various metals (Be, Si, Ti, Zr, Nb, Mo) with oxides (Al_2O_3, BeO, ZrO_2 (stabilized), TiO_2, MgO, ThO_2) in the temperature range 1400 to 1800°C in a neutral atmosphere have been studied. Literature data and calculations for metal-ceramic interfacial reactions indicate the general order of reaction although exact calculations are not possible with present data. Reactions may either be nonreactive or react to yield a physically unaltered surface. Specific types of reaction encountered were corrosion of the interface, formation of a new boundary phase at the interface, and a penetration and alteration of oxide properties attributed to solid solutions. Additional measurements and recalculations of surface tension have been carried out, and the effect of a Fe-0.1% Ti melt has been investigated. Various results indicate that oxygen solubility strongly affects the surface tension found. A microscopic furnace for investigating sintering has been completed and is ready for operation. A description and drawing of the furnace are included.

CORROSION

1450

Oregon Univ.

POLAROGRAPHIC STUDY OF CORROSION PHENOMENA; FINAL REPORT; OCTOBER 1, 1946–OCTOBER 31, 1950; by Pierre Van Rysselberghe. Jan. 1951. 8p. (U15284)

Titles are listed for various papers describing the activities and results of research of this project. (c.f. TIP U1029; U8517)

GEOLOGY AND MINERALOGY

1451

Department of Mines and Technical Surveys (Canada)

ACTIVATION ASSAYING FOR TANTALUM IN ORES, by G. G. Eichholz. Nov. 6, 1951. 24p. (NP-3601; TR-93/51)

The possibility of assaying the Ta content of ores by a radio-activation method is discussed. The relevant data for Ta-bearing ores are presented and it is shown that the detection of induced activity in Ta ores after exposure to a neutron source is feasible. The time required for irradiation, availability of neutron sources and amount of sample material needed are considered and found to be satisfactory for practical applications. A simplified procedure is outlined for such Ta assays and for the correction required if the ore contains appreciable amounts of U. (auth)

1452

Geological Survey

THE QUANTITATIVE DETERMINATION OF CALCITE ASSOCIATED WITH CARBONATE-BEARING APATITES; by Sol R. Silverman, Ruth K. Fuyat, and Jeanne D. Weiser. Aug. 1951. 26p. (TEI-118)

The CO_2 combined as calcite in carbonate-bearing apatites has been distinguished from that combined as carbonate-apatite, or present in some form other than calcite, by use of x-ray powder patterns, differential thermal analyses, and differential solubility tests. These methods were applied to several pure apatite minerals, to one fossil bone, and to a group of phosphorites from the Phosphoria formation of Permian age from Trail Canyon and the Conda mine, Idaho, and the Laketown district, Utah. With the exceptions of pure fluorapatite, pure carbonate-fluorapatite, the fossil bone, and one phosphorite from Trail Canyon, these substances contain varying amounts of calcite, but in all the samples an appreciable part of the carbonate content is not present as calcite. The results of solubility tests, in which the particle size of sample and the length of solution time were varied, imply that the carbonate content is not due to shielded calcite entrapped along an internal network of surfaces. (auth)

1453

Geological Survey

HYDROTHERMAL URANOTHORITE IN FLUORITE BRECCIAS FROM THE BLUE JAY MINE, JAMESTOWN, BOULDER COUNTY; COLORADO; by George Phair and Kiyoko Onoda. Mar. 1951. 19p. (TEI-144)

In the course of thin-section and heavy-mineral studies of fluorite breccias from Jamestown, Colo., the mineral thorite, variety uranothorite, was identified on the basis of chemical, spectrographic, optical, and x-ray data. (auth)

1454

Geological Survey

SUMMARY OF THE RESEARCH WORK OF THE TRACE ELEMENTS SECTION, GEOCHEMISTRY AND PETROLOGY BRANCH; FOR THE PERIOD JANUARY 1–MARCH 31, 1951; by John C. Rabbitt. May 1951. 44p. (TEI-151)

Progress is reported in investigations supporting the field appraisal of known uraniferous deposits. Research work consists of mineralogic and petrologic investigations of radioactive rocks, minerals, and ores; investigations of chemical methods of analysis for U, Th, and other elements and compounds in radioactive materials, and related chemical problems; investigations of spectrographic methods of analysis for a wide variety of elements in radioactive materials; and investigations of radiometric methods of analysis as applied to radioactive materials.

1455

Geological Survey

SUMMARY OF THE RESEARCH WORK OF THE TRACE ELEMENTS SECTION, GEOCHEMISTRY AND PETROLOGY BRANCH, FOR THE PERIOD JULY 1–SEPTEMBER 30, 1951; by John C. Rabbitt. [nd] 33p. (TEI-182)

This report summarizes the research work of the Trace Elements Section, Geochemistry and Petrology Branch, U. S. Geological Survey, for the period July 1–Sept. 30, 1951. Research work in the following fields is described: (1) mineralogic, petrologic, and geochemical investigations of radioactive rocks, minerals, ores, and waters; (2) investigations of chemical methods of analysis for uranium, thorium, and other elements and compounds; (3) investigations of spectrographic methods of analysis for a wide variety of elements in radioactive materials; (4) investigations of radiometric methods of analysis as applied to radioactive materials.

1456

Geological Survey

TREASURE HILL AREA, LARIMER COUNTY, COLORADO; by Donald G. Wyant. 6p. map. (TEM-9B)

The Treasure Hill area consists of eight mining-lode claims in Sects. 10 and 15, T. 9 N., R. 70 W., Larimer Co., Colo. All of the workings were examined and samples were taken from most of them. The results of the examination indicate that there is little or no detectable radioactivity in the schist and granite of the area.

1457

Geological Survey

RESULTS OF DIAMOND DRILLING MERRY WIDOW CLAIM, WHITE SIGNAL, GRANT COUNTY, NEW MEXICO; by H. C. Granger and H. L. Bauer, Jr. 10p. maps. (TEM-146A)

A diamond-core-drill hole was drilled during April and May, 1950, on the Merry Widow claim, White Signal district, Grant Co., N. Mex., to explore the torbernite deposit below the oxidized zone. The country rock on the claim is pre-Cambrian granite and is cut by mafic and felsic dikes and quartz-pyrite veins. The hole is 650 ft long and intersects the Merry Widow vein zone between 520 and 550 ft. Narrow radioactive zones are found to a depth of 550 ft, but the Merry Widow vein contains the most radioactive material. The vein has been thoroughly oxidized by circulating meteoric waters to a depth, down the dip, of a least 550 ft; no primary U minerals were found.

1458

Geological Survey

RED AND GRAY CLAY UNDERLYING ORE-BEARING SANDSTONE OF THE MORRISON FORMATION IN WESTERN COLORADO; by Alice Dowse Weeks. May 1951. 19p. (TEM-251)

A preliminary study of the clays underlying the ore-bearing sandstone of the Morrison formation, Colo., has tentatively identified the chief clay mineral as hydrous mica. Complete and partial chemical analyses show that the red clay contains more total iron and ferric iron than the gray clay. Spectrographic analyses of minor constituents show no significant difference between the red and gray except in iron content. Quartz and carbonate have a wide range in quantity that is not related to the color of the clay. Insufficient evidence is available from these specimens to indicate whether the gray altered from the red clay. (auth)

1459

Geological Survey

THEORY OF GAMMA-RAY LOGGING; PRELIMINARY CALCULATIONS; by A. Y. Sakakura. Dec. 1951. 11p. (TEM-306)

In cooperation with the Oak Ridge National Laboratory, a series of experiments was performed by the U. S. Geological Survey to study theoretically the calibration of diamond-drill-hole logging devices under varied conditions of density of the medium, electronic density, and drill-hole radius. Preliminary calculations show that the counting rate for a fixed-source density varies inversely as the electronic density of the source-bearing medium, that the counting rate in a drill hole is a linear function of the ratio of the electronic density of the medium in the drill hole to that of the source-bearing medium where that ratio is small, and that the radius dependence of the counting rate lies between $\underline{a}$ and $\underline{a}^2$, where $\underline{a}$ is the radius of the drill hole. (auth)

1460

PRESENCE OF URANIUM AND TUNGSTEN IN THE MINERALIZATION OF AZEGOUR (HIGH ATLAS AT GUEDMIOUA, MOROCCO). Francois Permingeat. Compt. rend. 234, 123-4 (1952) Jan. 2. (In French)

Pitchblende has been identified in a molybdenite deposit at Azegour, Morocco. The mineral is associated with pyrite and hematite in a calcite-quartz gangue. The U content has not been determined. The W minerals scheelite and powellite also have been found in this deposit.

1461

PRELIMINARY OBSERVATIONS ON THE PRESENCE OF A URANIUM VANADATE IN THE PHOSPHATE DEPOSITS OF MOROCCO. Camille Arambourg and Jean Orcel. Compt. rend. 233, 1635-6(1951) Dec. 19. (In French)

A high-V vanadate of U of the tyuyamunite, carnotite, or ferghanite type has been observed in fair quantities and general distribution in the Moroccan phosphate basins north and south of the Oum-er-R'bia. The greenish-yellow mineral occurs in fissures in calcareous or siliceous strata. No K is present in the mineral. The percentage of U has not been determined.

METALS AND METALLURGY

1462

Los Alamos Scientific Lab.

ON THE CUBIC LAW OF OXIDATION; by James T. Waber. [nd] 9p. (AECU-1830; LADC-1083)

The existing information on the cubic law of oxidation of metals is summarized, and new data obtained with Ta and Ti are presented which indicate that the law may have a greater range of applicability than has been generally expected.

1463

Brookhaven National Lab.

THE MEASUREMENT OF SPATIAL PARTICLE SIZE BY THE "LINE-AREA" METHOD, by R. J. Teitel and O. F. Kammerer. [nd] 13p. (BNL-1059)

With the derived expression $P = 4n_1/\pi n$ the average spatial particle or grain size P can be calculated from the number n_a of particles per unit area of the polished section and the number n_1 of particles per unit length of line drawn at random across the polished surface. For a single-phased alloy having equiaxed and uniform particle shape the relation is $P = 1.5/n_1$. The number of particles of grains per unit volume is also calculated, thus giving information about the mode of dispersed phases.

1464
Ames Lab.
THE PREPARATION OF RARE EARTH METALS; by F. H. Spedding and A. H. Daane. Jan. 28, 1952. 9p. (ISC-205)

In order to prepare highly pure rare-earth metals, a technique was devised whereby rare-earth chlorides are reduced by Ca in Ta crucibles; the resulting rare-earth metal is vacuum cast in Ta containers. Sm, Eu and Yb chlorides are reduced only to their stable divalent state and can thus be efficiently removed from rare-earth mixtures by such metallurgical processing. (auth)

1465
Los Alamos Scientific Lab.
LOW-COPPER NICKEL-SILVER OF IMPROVED CHEMICAL AND PHYSICAL PROPERTIES; by Douglas W. Grobecker, Denton T. Doll, and James M. Taub. Nov. 1, 1951. 34p. (LA-1324)

An alloy containing nominally 40% Cu, 32% Ni, and 28% Zn has proved to be a castable composition yielding dense, gas-free castings. This composition is differentiated from the commercial nickel-silvers by the relatively high Ni and Zn contents which prevent melting and casting by the usual techniques. This alloy can be inductively melted and the charge analysis maintained within ±0.75% for all constituents if proper techniques involving close temperature control and a proper slag cover are used. A suitable slag composition is obtained from a melted mixture of 52% soda ash, 27% borax, and 21% silica. This slag can be thickened during the melt-refining stage by an addition of silica sand. The thickened slag can be readily skimmed from the melt surface prior to pouring the melt. The low-Cu alloy has superior corrosion resistance in most of the mediums tested and elevated strength properties as compared with commercial Grade B nickel-silver. The low-Cu alloy may prove to be of economic value. (auth)

1466
NEPA Div., Fairchild Engine and Airplane Corp.
THE PRESENT STATUS OF THE ART OF MOLYBDENUM FABRICATION; by C. E. Swartz. May 10, 1950. 21p. (NEPA-1406)

Capacities and equipment of the various Mo suppliers, methods of working (rolling, drawing, welding, brazing, etc.), surface protective agents, and possible alloying metals are summarized. Mechanical properties of Mo bars and sheets are tabulated.

1467
Massachusetts Inst. of Tech.
SOLID SOLUTIONS AND GRAIN BOUNDARIES; TECHNICAL PROGRESS REPORT NO. 9, SCOPE II; by B. L. Averbach, M. Cohen, P. A. Flinn, E. E. Underwood, W. E. Flanagan, P. S. Rudman, and J. Hilliard. Dec. 31, 1951. 6p. (NYO-581; Technical Progress Report No. 9, Scope II; D.I.C. 6832)

Factors affecting thermodynamic stability of solid solutions in the macroscopic sense are reviewed. Attempts to describe the detailed atomic arrangements which the solution must take to be consistent with the thermodynamic information and to measure directly the corresponding atomic arrangements by means of x-ray techniques are discussed. Data from phase studies of Au-Ni and Au-Fe alloys are included.

1468
New York Univ.
THE RATE OF CORROSION OF SILVER IN FERRIC PERCHLORATE SOLUTIONS; by Cecil V. King and Frances S. Lang. Jan. 3, 1952. 25p. (NYO-630(Rev.))

Silver dissolves much more slowly in ferric perchlorate and nitrate than in ferric sulfate solutions. A detailed study of the rate in perchlorate solutions has been made, with the effect of concentration of ferric, ferrous and silver ions, of other salts including sulfates, of stirring speed, temperature and electrical polarization. Two factors are responsible for the difference in rates: (a) silver perchlorate is more strongly adsorbed on silver than silver sulfate is, and (b) a sulfato-ferric complex ion reacts more rapidly than the normal hydrated ferric ion. Spectrophotometric evidence is given for the existence of the sulfato-ferric ion. (auth)

1469
Columbia Univ.
PROGRESS REPORT ON THE MECHANISM OF METALLOGRAPHIC ETCHING, by George L. Kehl and Max Metlay. Oct. 31, 1951. 7p. (NYO-830)

Progress is reported in a study of the mechanism of metallographic etching of α-β brass. Open-circuit potential measurements of each phase in α-β brass against a saturated calomel electrode were made and results are summarized. Data are included from experiments on the Bi-Cd system, as an example of an alloy system in which two phases are entirely unlike in composition and exhibit no significant mutual solubility. Preliminary data indicate electron-diffraction methods are superior to x-ray-diffraction methods in studies of reaction products formed and the nature of the etched surface of α-β brass.

1470
Massachusetts Inst. of Tech.
FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION; TECHNICAL PROGRESS REPORT NO. 5, SCOPE III; by B. L. Averbach, M. Cohen, S. Allen, G. P. Conard, and P. Fopiano. Dec. 31, 1951. 4p. (NYO-860; Technical Progress Report No. 5, Scope III; D.I.C. 6802)

Progress is reported in a study of plastic deformation of metallic crystals and the changes which occur on annealing such crystals after deformation. Data are given for deformation of single crystals of Cu-Si, Cu, Al, and Zn.

1471
Massachusetts Inst. of Tech.
THERMODYNAMICS OF METAL SOLUTIONS; TECHNICAL PROGRESS REPORT, SCOPE I; by M. B. Bever, L. B. Ticknor, G. Scatchard, and C. Wagner. Nov. 30, 1951. 3p. (NYO-919)

Brief statements, containing no appreciable scientific data, are presented on activities in electrochemical measurements, of activities in ternary alloys (specifically Bi-Cd-Sn) and their interpretation, spectroscopic measurement of vapor-solid equilibria of Zn, and calorimetric measurements of heats of solution in metallic systems (Au and Ag in Sn and Cu in Sn) and retained energy of cold working.

1472
Pittsburgh Univ.
LOW TEMPERATURE SPECIFIC HEATS, ENTROPY AT 25°C AND THE RESIDUAL ENTROPY OF THE INTERMETALLIC COMPOUND MgCd; PROGRESS REPORT FOR OCTOBER 1, 1951 TO JANUARY 1, 1952; by R. S. Craig, C. B. Satterthwaite, and W. E. Wallace. Jan. 10, 1952. 23p. (NYO-946)

The specific heat of a Mg-Cd alloy containing 50.52 at. % Cd was measured between 11 and 304°K. From these data, extrapolated to 0°K by the Debye T^3 law, the entropy increase between absolute zero and 25°C was found to be 9.83 E.U./g atom. The residual entropy of MgCd was evaluated from these data by two methods. The first, which consisted of estimating the configurational entropy between 200 and 300°K and extrapolating below 200° to 0°K by the Bragg-Williams equation, gave +0.005 E.U./g atom for the entropy at 0°K. The second, which used previously determined values for the entropy of MgCd at 270°C and its specific heat gave a value, based solely on experiment, of 0.00 E.U./g atom. The entropy of MgCd at 25° is 9.80 E.U./g atom.

1473
Metals Research Lab., Carnegie Inst. of Tech.
PROGRESS REPORT FOR OCTOBER, NOVEMBER, DECEMBER, 1951; by R. Smoluchowski, L. Couling, S. Hayes, R. Flanagan, C. W. Haynes, R. W. Turner, and S. Toney. Jan. 15, 1952. 4p. (NYO-3181)

Study of grain boundary diffusion in the Cu-Zn system leads to an evaluation of the activiation energies as a function of orientation. A theoretical consideration is in agreement with the experimental data. Other diffusion systems are progressing. The use of balanced x-ray filters will speed up the small angle scattering investigation. (auth)

1474
Sylvania Electric Products, Inc.
DEVELOPMENT OF POROSITY BY UNEQUAL DIFFUSION IN SUBSTITUTIONAL SOLUTIONS; by R. W. Balluffi and B. H. Alexander. [nd] 23p. (SEP-83)

Sandwich type Cu−α−brass, Cu−Ni, and Ag−Au diffusion couples were prepared by welding disks together under pressure at elevated temperatures. In each case multiple sandwiches were made containing A−A, A−B, and B−B interfaces. After diffusion, all specimens were sectioned and the annealed interfaces were examined metallographically. The results observed are discussed in relation to the vacancy theory developed by Bardeen and Herring (Trans. Am. Soc. Metals 43A, 87(1951)) and Seitz (Acta Cryst. 3, 355 (1950)). Porosity may develop in any part of a substitutional solution diffusion couple which loses mass as a result of unequal diffusion. Couples may be divided into two parts separated by the moving Kirkendall interface. The side initially containing the higher-mobility atoms loses mass and partially contracts owing to sintering of the porosity generated there. The other side gains this mass and expands but develops no porosity. The results of the process seem to be about the same as would result from replacing the atoms lost by unequal diffusion with vacancies which then precipitate and spheroidize or else disappear by a sintering mechanism. 11 figures.

1475
General Electric Research Lab.
DEVELOPMENT OF ZIRCONIUM BASE ALLOYS; NINTH QUARTERLY REPORT; by J. H. Keeler. Jan. 5, 1952. 23p. (SO-2504; RL-640; Progress Report No. 10)

Considerable attention was devoted to chemical composition, allotropic transformation temperature, and preferred orientation of high-purity Zr before and after arc melting, and to binary alloys of Zr-Ta and Zr-Nb. The mechanical properties of (1) cold-rolled, (2) recrystallized, and (3) arc-melted, cold-rolled, and recrystallized crystal-bar material were studied by obtaining true stress−true strain data at room temperature. Mechanical properties at 25 to 28°C of Nb alloys are reported. Various binary alloys containing small percentages of Al, Fe, Mo, or Cr have been cold-rolled into sheets. Alloys containing larger quantities of these elements have been hot-rolled to a thickness of 0.060 to 0.070 in. 17 figures.

1476
SIGMA PHASE IN VANADIUM-NICKEL ALLOYS. W. B. Pearson and J. W. Christian. Nature 169, 70-1(1952) Jan. 12.

An x-ray-diffraction study has been made of a V-Ni σ-phase single crystal containing 60 at. % V. The unit cell is tetragonal with a = 8.95 and c = 4.63 kX. The space group is P4/mnm, P4mn, or P$\bar{4}$n2. The structure is compared with those reported for σ phases of β-U, Fe-Cr, and Co-Cr.

1477
QUANTITATIVE MEASUREMENT OF PREFERRED ORIENTATION IN ROLLED URANIUM BARS. G. B. Harris. Phil. Mag. (7) 43, 113-23(1952) Jan.

The preferred orientation of uranium bars hot-rolled and cold-rolled in the α range has been determined quantitatively by X-ray diffraction using a Geiger counter. It is shown that hot-rolling with a slight reduction causes the 010 planes to become strongly and the 110 planes weakly oriented perpendicular to the rolling direction. Further hot-rolling causes the 110 planes to become strongly and the 010 planes weakly oriented perpendicular to the rolling direction. Cold-rolling with light reduction causes the 010 planes to become strongly and the 130 planes weakly oriented in the planes perpendicular to the rolling direction. (auth)

1478
THE PREDICTION OF URANIUM DEFORMATION TEXTURES. E. A. Calnan and C. J. B. Clews. Phil. Mag. (7) 43, 93-104(1952) Jan.

Tension, compression and rolling textures have been derived for the orthorhombic metal α uranium. From a consideration of the relative importance of the slip and twinning mechanisms it is possible to differentiate between the textures developed after slight and severe deformations at both room and elevated temperatures. (auth)

1479
MAGNESIUM-CADMIUM ALLOYS. II. THE USE OF THE ELECTROCHEMICAL CELL TO DETERMINE THE HEATS, FREE ENERGIES AND ENTROPIES OF FORMATION OF THE SOLID ALLOYS IN THE TEMPERATURE RANGE ABOVE THE ORDER-DISORDER CURIE POINTS. Forrest A. Trumbore, W. E. Wallace, and R. S. Craig. J. Am. Chem. Soc. 74, 132-6(1952) Jan. 5.

The cell Mg(s)/Mg^{++} (in LiBr-RbBr)/Mg[in Cd(s)] was employed to determine the changes in heat content, free energy, and entropy accompanying the formation of solid Mg-Cd alloys at temperatures ranging from 270 to 300°C. All the alloys are formed exothermally with a maximum in the heat evolved being 2.02 kcal/g atom at 42% magnesium. The alloys are formed with a release of free energy at all compositions, and the variation of free energy with composition indicates a stable single phase system over the entire composition range. An entropy increase accompanies the formation of all the alloys. A comparison of the observed entropy with the ideal entropy of mixing shows a pronounced deficiency for alloys having compositions around 50%. This has been attributed to the existence of short range order. An entropy excess occurs in the cadimium-rich alloys. Explanations for the anomalous entropy excess can be provided by postulating the existence of vacant lattice sites to the extent of 2 to 3% and/or an exceptionally large degree of vibrational freedom in high-cadmium alloys. The latter possibility seems to be a likely one in view of the difference in packing in the two pure metals as suggested by their strikingly different axial ratios. Rough correspondence between the observed results and those expected from the quasi-chemical theory were noticed, although such correlations are probably of dubious significance as the volume of the alloys does not obey the additivity relationship and the packing varies with composition. (auth)

1480
MAGNESIUM-CADMIUM ALLOYS. III. SOME CALORIMETRICALLY DETERMINED HEATS OF FORMATION AT 25°. Thomas M. Buck, Jr., W. E. Wallace, and Richard M. Rulon. J. Am. Chem. Soc. 74, 136-9(1952) Jan. 5.

The heats of formation of several Mg-Cd alloys are presented. The results were obtained from the difference in heat of solution of the alloy and a mixture having the same mass and composition. A differential calorimeter was employed to measure the differences directly. The measured heats of formation at 25°C are −1595 ± 60, −1960 ± 50, −2197 ± 70, and −775 ± 70 cal/g atom of alloy for compositions 25.27, 49.50, 52.64, and 74.81% Mg, respectively. Comparisons are made with similar data from other investigations. Agreement is poor with older calorimetrically determined values but is reasonably satisfactory with the values obtained in this Laboratory using the electrochemical cell. Efforts to determine the energies associated with the formation of the magnesium-cadmium superstructures by comparing the heats of formation above and below the order-disorder Curie points were unsuccessful. Some experiments are reported dealing with the energetics of the hydrogen reduction of chloroplatinate and chloroplatinite ions, substances useful for accelerating the acid solution of metals, such as Cd, which have high hydrogen overvoltages. Chloroplatinate ion, used in most of the classic work on the heat of solution of simple metals in acids, was found to be less satisfactory, in view of its reduction to two lower valency states, than chloroplatinite ion. Possible errors in published values of the heats of solution of the simple metals due to an incorrect accounting for the accelerator correction are mentioned. A rough value, useful in applying an accelerator correction, for the hydrogen reduction of chloroplatinite ion was obtained. At 25°C this value is 0.21 ± 0.01 cal/mg of Pt deposited. (auth)

PHYSICS

1481
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF AUGUST 16, 1951; by Sergey Shewchuck. Sept. 15, 1951. Decl. with deletions Jan. 14, 1952. 11p. (AECD-3292; UCRL-1458)

Bevatron Status. W. Brobeck. Construction status, motor-generator-set noise problem, advantages of the high-field pole tips, etc., are discussed very briefly. μ-Meson-Decay Spectrum. Harmon Hubbard. A decay-electron energy curve based on 435 μ-meson tracks observed in a cloud chamber is shown; the average energy is 33 Mev and the maximum energy is 53.5 ± 2.5 Mev. It is hoped to discover whether a μ-meson decay is of the same type as β decay. Complex Alpha Structure in Heavy Elements. F. Asaro. Studies with a magnetic α-ray spectrograph and nuclear films are presented showing the following energy levels in kev above the ground state of the daughter nuclide and the percentages (in parentheses) of α decays to the given level. Pu^{239}: 0(69), 12(21), 51(10). Am^{241}: 0(0.15), 11.2(0.14), 42.8(0.10), 70.3(85), 112.9(14), 166.5(1.3). Cm^{242}: 0(73), 44(27).

1482
Oak Ridge National Lab.
MANUAL OF PILE ENGINEERING; CONSTANTS AND CONVERSION FACTORS. [nd] 26p. (CF-51-8-10)

The values of the physical constants used are those proposed by Birge (Reports on Progress in Physics VIII, 90(1941); Revs. Modern Phys. 13, 233(1941)). The constants are grouped under the following headings: fundamental constants, distance, velocity, energy and mass, dimensionless constants, area, time, frequency, wave number, number of molecules, relating to charge of electrons, relating to Planck's constant, relating to Boltzmann's constant, macroscopic, magnetic, gravitational, radiation, temperature, and density of various gases. An extensive list of conversion factors is included.

1483
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
PROGRESS REPORT; [AUGUST 31, 1951 TO NOVEMBER 30, 1951]. Nov. 30, 1951. 72p. (NP-3561; Progress Report [No. 23]; U20309)

Separate abstracts have been prepared for the following sections of this report: Chemistry of the Fission Elements, Cosmic Ray, Elementary Particle Scattering, and M.I.T.-O.N.R. Generator Construction and High Voltage Research Groups, p.1-17; Nuclear Chemistry (Inorganic) Group, p.18-38; and Nuclear Chemistry (Organic), O.N.R. Generator, Radioactivity and Cyclotron, Synchrotron, and Theoretical Groups, p.39-70.

1484
Westinghouse Research Labs.
THE MEASUREMENT OF LOW TEMPERATURES; by C. T. Linder. Feb. 2, 1950. 68p. (NP-3595; Research Report R-94433-2-A)

Background material in the field of cryogenics is reviewed. The low-temperature scale is discussed and methods of measuring low temperatures are presented in detail. Temperature, gravity, and capillary depression corrections for barometers and manometers are considered. A number of tables and graphs pertinent to low-temperature determinations are included. 67 references.

1485
Oak Ridge National Lab.
QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1951; PHYSICS DIVISION; by L. D. Roberts, ed. Issued Jan. 16, 1952. 55p. (ORNL-1092)

Separate abstracts have been prepared on the following sections of this report: Neutron Diffraction, sect.1; Short-lived Isomers, sect.2; Interaction of Low-energy Ions with Solids and Gases, sect.3; High Voltage Program, sect.4; Short-period Activities, sect.5; Investigations with the Scintillation Spectrometer, sect.8; and Theoretical Physics, sect.9.

1486
Missouri Univ.
X-RAY ABSORPTION FACTORS FOR COATED CYLINDERS AND THEIR APPLICATION IN THE MEASUREMENT OF THIN FILMS, by Eugene B. Hensley. Sept. 1, 1950. 16p. (U12106; Technical Report No. 3)

1487
Division of Research, AEC
PHYSICS IN THE ATOMIC ENERGY PROGRAM; by Thomas H. Johnson. Dec. 27, 1951. 13p. (WASH-72)

The role of physicists in the Atomic Energy program is surveyed. Fields of inquiry now being pursued are mentioned, and the wide range of investigation necessary for understanding nuclear interactions is stressed. The setup of the Commission's research program including the National Laboratories and research projects in university and industrial laboratories is discussed in general. The criteria for effective administration of research contracts are shown to be quite different from those for direction of applied work.

COSMIC RADIATION

1488

Microwave Lab., Stanford Univ.

NEUTRAL V PARTICLE DECAY AND THE NEGATIVE PROTON; by L. I. Schiff. Dec. 1951. 4p. (ML-154)

Neutral V particles (V°) which decay into a proton and a negative meson have been observed by several investigators, and the author hypothesizes as to why a neutral V ($\overline{V}^\circ$) particle which decays into a negative proton and a positive meson does not also appear with comparable probability. It is suggested that V° (or $\overline{V}^\circ$) particles can actually be produced singly by some kind of coalescence of a proton (or negative proton) and a negative (or positive) meson; the apparent lack of reversibility between V° formation and decay has to do with the existence of states connecting V° and its decay products which are only present with appreciable probability in a region of high temperature.

1489

Rochester Univ.

PRIMARY FLUX OF HIGH ENERGY PROTONS AND α-PARTICLES, by M. F. Kaplon, D. M. Ritson, and E. P. Woodruff. Dec. 14, 1951. 4p. (NYO-3041)

Primary-flux values of high-energy protons and α particles have been measured using the emulsion-cloud-chamber technique. A total of 14 showers in the energy region of $10^{12}-10^{13}$ ev was investigated. The examination showed that 6 events were γ-ray induced and 8 were caused by nuclear interactions. The median energy of these 8 events, estimated from kinematic considerations, was 4.5×10^{12} ev. The integral primary flux with energy greater than 4.5×10^{12} ev was calculated to be 0.04 particles/m^2/ster/sec at the top of the atmosphere, assuming the flux to be isotropic.

ELECTRONS

1490

Research Lab. of Electronics, Mass. Inst. of Tech.

MICROWAVE DETERMINATION OF THE PROBABILITY OF COLLISION FOR SLOW ELECTRONS IN GASES; by Arthur V. Phelps, O. T. Fundingsland, and Sanborn C. Brown. July 23, 1951. 9p. (NP-3560; Technical Report No. 211; U20227)

A microwave method is outlined for determining P_c, the collision probability for momentum transfer for electrons in thermal equilibrium with a gas. An integral equation is developed which gives the ratio of the resistive and reactive components of the microwave conductivity in terms of the collision frequency for electrons with the gas atoms. Two approximate solutions are given for the collision frequency as a function of electron energy. An experimental procedure is described in which the conductivity ratio is determined from the shift in the resonant frequency and the change in conductance of a resonant cavity. Measurements are made during the decay of a pulsed discharge after the electrons have cooled to the gas temperature. For electrons having a mean energy of 0.039 ev the following results were obtained for P_c at 1 mm Hg pressure in units of cm^2/cm^3: He, 19; Ne, 3.3; A, 2.1; Kr, 54; Xe, 180; H_2, 46; and N_2, 15.

GASES

1491

Knolls Atomic Power Lab.

THE SECOND VIRIAL COEFFICIENT OF A 6-9 GAS AT HIGH TEMPERATURES, by Leo F. Epstein and Celesta J. Hibbert. Dec. 15, 1951. 7p. (AECU-1838)

The second virial coefficient, $G_9(\theta)$, of a gas which satisfies a Lennard-Jones 6-9 potential was derived. The convergence properties of this series are such that it is difficult to evaluate $G_9(\theta)$ for large values of θ, i.e., at low temperatures. It has been summed for the range $0 \leq \theta \leq 2$ using punched-card computing-machine technique. The results given to 10-place accuracy are tabulated. In addition to the function $G_9(\theta)$ itself, the first three derivatives have been computed and tabulated. A comparison is given for the results for a 6-9 potential with those previously derived for a 6-12 potential. The graphs show that, over a limited temperature range, $G_{12}(\theta)$ can be approximated by $AG_9(a\theta)$, where A and a are constant. The tables given are adequate for all of the permanent gases.

INSTRUMENTS

1492

Los Alamos Scientific Lab.

SPURIOUS PULSES FROM THE TYPE 5819 PHOTOMULTIPLIER TUBE; by Robert J. Lanter and Robert W. Corwin. [nd] 5p. (AECU-1829; LADC-1084)

Primary scintillation pulses in the type 5819 photomultiplier tube are usually followed by a number of small spurious pulses, here termed "afterpulses." The spurious pulses are not produced by the electronic equipment nor are they related to type of radiation or nature of scintillator. The afterpulses are related to the amplitude of the primary pulses in amplitude, frequency, and length of time during which they appear. A large scintillator pulse will produce as many as 50 afterpulses, which show up throughout an interval of as long as 40 μsec after the primary pulse. The number and size of afterpulses vary from tube to tube when tested under identical voltage and light conditions. The number and size are also related to the gain at which the photomultiplier tube is operated, apparently because the gain affects the primary pulse amplitude. No definite conclusions as to the exact nature of the afterpulses can be drawn as yet.

1493

Atomic Energy Research Establishment, Harwell, Berks (England)

ELECTROMAGNETIC RESONATORS FOR TESTING THE DIELECTRIC CONSTANT AND DIELECTRIC POWER FACTOR OF DISCS OF TITANIA CERAMIC AT ABOUT 3,000 MC/S; by J. H. Adlam. [nd] 17p. (AERE-G/R-810)

Two similar resonators are described. One is used to test plane ceramic disks 1.85 in. in diameter by 0.066 in. thick, which were originally made to be tested in a resonator at X-band frequencies. The other resonator is used to test the disks for a linear accelerator. These disks have a circular hole in the center, the size of disk being 2.373-in. OD by 0.768-in. hole diameter by 0.150 in. thick. The dielectric loss in these resonators is larger than the metal loss, and the Q factor measured is of the same order as the reciprocal of the dielectric power factor. The dielectric constant, which is approximately equal to 90, can be measured to an accuracy of about 1 part in 100. The dielectric power factor, which is between 1/2500 and 1/3000, can be extimated to about 1 part in 5 or better.

1494

Atomic Energy Project (Canada)

OPERATING AND TECHNICAL MANUAL; E. H. T. UNIT-AEP 1007A. Mar. 1950. 18p. (IM-7; N.R.C. 2399)

1495

Atomic Energy Project (Canada)

LINEAR AMPLIFIER TYPE AEP 1444, by N. F. Moody and W. D. Howell. Apr. 1950. 22p. (IM-8; N.R.C.-2400)

1496

Lewis Flight Propulsion Lab.

A MULTIPLE-RANGE SELF-BALANCING THERMOCOUPLE POTENTIOMETER; by I. Warshawsky and M. Estrin. Nov. 5, 1951. 15p. (NACA-RM-E51H31)

A multiple-range potentiometer circuit is described that provides automatic measurement of temperatures or temperature differences with any one of several thermocouple-material pairs. Techniques of automatic reference-junction compensation, span adjustment, and zero suppression are described that permit rapid selection of range and wire material, without the necessity for restandardization, by setting of two external tap switches.

1497

National Bureau of Standards

QUARTERLY PROGRESS REPORT OF THE OFFICE OF BASIC INSTRUMENTATION; FOR THE QUARTER ENDING SEPTEMBER 30, 1951. [nd] 41p. (NBS-1281; U20260)

Research progress is summarized for the following projects: $BaTiO_3$ accelerometer; vacuum-tube accelerometer; electron interferometer; CO_2 hypsometer; pneumatic instruments based on critical flow; strain and displacement instruments; spring transducers; medical physics instrumentation; humidity measurement by spectroscopic methods; calibrated vacuum-leak instrument; cathode-ray-oscillograph beam intensification; mass spectrometer for studying solids; instrumentation utilizing magnetic effects on mechanical vibrations; electron-beam magnetometer; new photomultiplier design; pulsed photomultiplier; mutual-inductance transducer; absolute measurement of vibration amplitudes; temperature determination with the noise thermometer; ultrasonic velocimeter for liquids; acoustic viscometer for gases; and anesthesia monitor. Nine dimensions are listed for a multidimensional system for classifying the instrument literature (cf. TIP U18947).

1498

Armour Research Foundation

THE DEVELOPMENT OF THERMOCOUPLES FOR TEMPERATURES IN THE REGION OF 1600° to 2000°C; FINAL REPORT. SEPT. 18, 1950. 115p. (NEPA-1580)

In an attempt to find satisfactory thermocouples for use in the temperature range 1600 to 2000°C in neutral, reducing, and oxidizing atmospheres, calibrations were made for combinations of W, Mo, Ta, Pt, Rh, Ir, and alloys of these metals. In a neutral atmosphere, optimum properties and performance were obtained with the W/Ir thermocouple. An equation was fitted to the W/Ir thermocouple calibration curve, and this report contains a table listing the computed emf for temperatures between 1000 and 2100°C. Tubes of alumina and sapphire were tested for protection of the thermocouples in mildly oxidizing and oxygen-rich atmospheres. In mildly oxidizing gases the alumina tubes were satisfactory for an average of 18 hr, and the sapphire tubes for 75 hr. The Ir/60% Ir, 40% Rh thermocouple required no protective shielding for temperature measurements in an oxidizing atmosphere.

1499

Oak Ridge National Lab.

SHORT-PERIOD ACTIVITIES, sect.5 of QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1951; PHYSICS DIVISION; by E. C. Campbell, J. H. Kahn, and K. L. Robertson. Issued Jan. 16, 1952. 3p. (ORNL-1092(sect.5))

A pulse-height analyzer capable of measuring the height of each of two coincident pulses has been developed using a cathode ray oscilloscope display technique. (auth)

1500

Atomic Energy Project, Univ. of Calif., Los Angeles

A REVOLVING SPECIMEN STAGE FOR THE ELECTRON MICROSCOPE, by F. W. Bishop and Sylvia B. Elliott. Issued Jan. 23, 1952. 8p. (UCLA-178)

The specimen stage was removed from an electron microscope and bored to accommodate a smaller circular stage which could be rotated by a turning mechanism operating through the specimen chamber door. This revolving stage permits the rapid orientation of the specimen in any desired direction, brings into view otherwise inaccessible fields, and can compensate for the image rotation with change in magnification.

1501

ON THE EVAPORATION OF RADIUM E. Takashi Mikumo. Compt. rend. 234, 89-91(1952) Jan. 2. (In French)

Evaporation of RaE (Bi^{210}) in a current of H_2 and its deposition on a metal disk attached to a water-cooled cold finger has been studied. A curve of temperature vs. percentage of RaE evaporated is shown. A 1-mc source of RaE on an 8-mm-diam. Cu disk was prepared by this distillation method.

MATHEMATICS

1502

A NOTE ON THE QUANTUM-MECHANICAL PERTURBATION THEORY. Per-Olov Löwdin. J. Chem. Phys. 19, 1396-1401 (1951) Nov.

The solution of the quantum-mechanical eigenvalue problem is discussed for cases when a series of approximate eigenfunctions is known. If these "unperturbed" states are divided into two classes, a perturbation formula is derived giving the influence of one class of states on the other in the final solution. The formula contains as special cases: (i) the Schrödinger-Brillouin formula for the eigenvalue of a nondegenerate state, (ii) a new simple formula for treating a class of degenerate states, and (iii) the splitting of the secular equation in cases where the system naturally consists of two independent parts in mutal interaction. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

1503

Los Alamos Scientific Lab.

MEASUREMENT OF FAST NEUTRON FLUX; by H. H. Barschall, L. Rosen, R. F. Taschek, and J. H. Williams. [nd] Los Alamos Scientific Lab. and Univ. of Minnesota. Decl. Jan. 22, 1952. 45p. (AECD-3294; LADC-1072)

The following methods of measurement of fast-neutron flux are described: (1) associated particle, (2) recoil particle, (3) methods of total source strength (thermalization method and radioactive-product method), (4) long-counter and similar methods, and (5) method of reaction-cross-section comparisons. The principles involved and the energy range is which each method is practical are discussed. Specific examples are cited in which each method has been used or might be used to advantage. Most of the report is devoted to flux determinations of monoergic neutrons; the extension of the methods to polyergic sources is discussed separately in the last section.

1504

Ames Lab.

BACKSCATTERING OF BETA-RAYS IN WINDOWLESS GEIGER-MÜLLER COUNTERS, by Darleane Christian, Wayne W. Dunning, and Don S. Martin, Jr. [nd] 9p. (AECU-1817)

The counting efficiency for a windowless, gas-flow type G-M counter was increased to about 80% of the radioactivity disintegration rates. This was accomplished by backscattering of β rays within the G-M tube. The backscattering elements investigated are Be, Mg, Al, Ni, Cu, Ag, Ta, and Pt. Counting rate for the β emitters Ni^{63}, S^{35}, Co^{60}, and P^{32} are so plotted that the counting efficiencies may be read directly for any backscatterer. It was noticed that, for the heavy-element backings, the counting rates were independent of, and over a wide range of, the β-ray energy.

1505

Atomic Energy Research Establishment, Harwell, Berks (England)

A FAST SCALE OF TEN (SCALAR—TYPE 1070A); by G. A. Howells. Sept. 6, 1951. 36p. (AERE EL/R-728)

A scale of ten is described having a mean dead time of about 0.25 μsec and a maximum counting rate for random pulses of 4×10^5 cps. The scaler consists mainly of a discriminator, a scale of five and a normal scale of two. The discriminator, whose mean dead time is fixed by a delay line, responds to input pulses 0.05 μsec wide. The scale of five is based on the energy storage principle and is unique in that the five energy levels are stable. Indication is provided on a meter. (auth)

1506

Argonne National Lab.

INSTRUMENT RESEARCH AND DEVELOPMENT DIVISION QUARTERLY REPORT; SEPTEMBER, OCTOBER, AND NOVEMBER, 1951, F. R. Shonka, Director. [nd] 8p. (ANL-4733)

A phase-shift method and an oscillographic method for measuring the slow component in the decay times of scintillation phosphors are described briefly. Use of a new-type polymerizing cement (3M, type EC-801) to seal a window to an Al reflector cup containing a NaI(Tl) crystal phosphor permitted total immersion in water for 1 month without crystal change. Cleaved and rough-finished surfaces gave better pulse-height resolution and larger pulse heights with these crystals than did polished surfaces. Disadvantages of the polyvinyl acetate (Gelva V-1.5) bonding between the lucite "light pipe" and the phototube of a scintillation probe are mentioned; they may be avoided at increased expense by lapping and polishing the lucite cylinder against the tube or by polymerization casting of a methacrylate cylinder onto the tube. Other design features of the scintillation probe are mentioned. The optical design of a pocket dosimeter that uses reflecting elements to illuminate the fiber and scale is described briefly; the design permits easy sensitivity control, zero-set adjustment, and construction of a collecting chamber in which nonconducting matter is at a minimum.

1507

Brookhaven National Lab.

ACTIVATION OF LiI CRYSTAL PHOSPHORS, by W. Bernstein and A. W. Schardt. [nd] 6p. (BNL-1067)

Lithium iodide crystals were grown with different activators (Tl, In, Sn, and Ag) and tested for pulse height and resolution with thermal neutrons from the BNL reactor. Results show that large LiI(Sn) crystals can be grown which give good resolution and pulse height. These crystals may be used in relatively small detectors with high efficiency for thermal and epithermal neutrons and for rough neutron-energy measurements in the region where the $Li^6(n,\alpha)He^3$ cross section is large enough.

1508

Atomic Energy Project (Canada)

REPORT ON FAST NEUTRON DOSIMETRY; by J. Dainty. May 17, 1950. 46p. (CRM-482)

Theoretical and experimental investigations show that the doses delivered to standard tissue by the fast neutrons and the γ rays from a neutron source can be measured by two chambers, one of polythene filled with ethylene and the other of polystyrene filled with acetylene. Probable errors are about 10% in the neutron dose and about 30% in the γ-ray dose. The theoretical reasons for choosing the materials used and the accuracy of the method are discussed in detail. The response of chambers with different conducting surfaces to Po-Be neutrons and γ rays was studied experimentally; the results generally agreed with theoretical calculations. The energy W required to produce an iron pair in ethylene and acetylene was determined by comparison with W for air. Finally the doses delivered to standard tissue by the neutrons and γ rays from a 1-c Po-Be source at 1 cm were measured.

1509

Johns Hopkins Univ.

SOME POLYSTYRENE SOLID SOLUTIONS AS SCINTILLATION COUNTERS, by Thomas Carlson and Walter S. Koski. Dec. 21, 1951. 4p. (NYO-955)

The scintillation efficiency and the spectral emission of 2% solid solutions of the following compounds in polystyrene were investigated: stilbene, diphenylbutadiene, diphenylhexatriene, diphenylacetylene, diphenyldiacetylene, anthracene, diphenylethane, and terphenyl. The wavelengths of the emission bands of each are tabulated, and the counting rates as a function of discriminator bias are shown graphically.

1510 1510

Naval Research Lab.

INSENSITIVITY OF INFRARED DETECTION USING TEMPERATURE SENSITIVE PHOSPHORS, by C. C. Klick and J. H. Schulman. Jan. 15, 1952. 4p. (NRL-3930)

The decrease in light output from a phosphor as the temperature is increased beyond a sufficiently high temperature may be used to indicate the temperature change produced by infrared radiation. The decrease in light output of the phosphor is thus a measure of the infrared energy. Separation of the light variation of the phosphor produced by the infrared light from the background luminescence was accomplished by chopping the infrared light at 10 cycles per second and amplifying the signal from the photomultiplier tube with a 10-cycle amplifier. The sensitivity of this method of infrared detection is limited by noise to less than that of other detectors by a factor of 10,000.

1511

Oak Ridge National Lab.

INVESTIGATIONS WITH THE SCINTILLATION SPECTROMETER, sect.8 of QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1951; PHYSICS DIVISION; by P. R. Bell, R. C. Davis, J. E. Francis, Judith Cassidy, and W. H. Jordan. Issued Jan. 16, 1952. 11p. (ORNL-1092 (sect.8))

New coincidence-spectrometer measurements of I^{131} with improved resolution have been made and a previously unknown γ ray of about 0.5-Mev energy has been detected. This new γ ray does not fit the previously accepted I^{131} decay scheme. The development of the hollow-crystal spectrometer has been continued and the instrument has been used for the study of the β radiation of Ca^{45}. It is now being used to study the β-γ coincidence spectrum of I^{131}. As a result of studies of the optical absorption of samples of anthracene, sodium iodide, mineral oil, and Canada balsam in the wave length range from 3200 to 5500 A, the resolution of the scintillation spectrometer has been much improved. Further improvements have been made by suitable treatment of the optical surfaces of the spectrometer. A new synchroscope with a vertical amplifier rise time of about 1 mμsec is in process of development for study of circuits and components to be used in very fast counting equipment and for the investigation of various discharge phenomena. The bluish-white glow emitted by water immediately surrounding an intensely radioactive U slug has been identified as Cherenkov radiation. (auth)

1512

Radiation Lab., Univ. of Calif.

SUMMARY OF RESEARCH PROGRESS MEETING OF OCTOBER 11, 1951; by Sergey Shewchuck. Dec. 7, 1951. 7p. (UCRL-1601)

Cherenkov Counters. R. Birge. A counter is sketched and briefly described whose main objective is to reduce the error due to the background of stray radiations caused by the incident particle and so to measure only the Cherenkov radiation. Use is made of a conical pipe having sides at an angle equal to the critical angle so as to reflect all the Cherenkov radiation.

New Results in European Laboratories. W. H. Barkas. The Imperial College, Birkbeck College of the University of London, and the University at Bristol were visited, and report is made of the work being done with nuclear emulsions. Some rare events relative to τ and κ mesons are mentioned. The following are very briefly discussed: decay of a particle of mass ~960; decay into a meson of a heavy particle going the wrong direction for a π meson; spectra of $e^{\pm}$ from μ decay; cosmic primaries between He and C; new emulsions containing Pt wires; and mobility of Ag ions in a lattice.

Meson Production in Nuclei by Protons. E. Henley. The details for this talk may be found in UCRL-1467; cf. NSA 5-6351.

MESONS

1513

Rochester Univ.
EXTREMELY HIGH ENERGY NUCLEAR INTERACTIONS, by M. F. Kaplon and D. M. Ritson. Dec. 11, 1951. 6p. (NYO-3039)

The angular distribution, multiplicity of penetrating particles, and ratio of neutral mesons to charged particles produced by collisions of cosmic-ray nucleons and α particles with nuclei of copper were studied by utilizing the technique of an "emulsion cloud chamber" to select high-energy events. The energy per nucleon of the primary causing event was estimated by the kinematical considerations. Despite the energy being estimated on the single nucleon-nucleon assumptions, in those cases where an accurate check is available by the energy-balance method, the two methods agree within statistical limits. The relevant data on the events completely or partially analyzed are summarized. The multiplicity of meson production was found to vary as $\gamma^{1/4}$, where γ is the energy (lab.) per nucleon of the primary, which is in agreement with the predictions of the Fermi theory.

1514

Rochester Univ.
ELECTROMAGNETIC INTERFERENCE EFFECTS IN CHARGED MESON-PROTON SCATTERING, by M. F. Kaplon. Jan. 28, 1952. 8p. (NYO-3045)

In order to demonstrate the nature of the electromagnetic interference effects, the differential cross section in the center-of-mass system has been calculated for process ($\pi^+ + p \rightarrow \pi^+ + p$) on the basis of the PS(PV) theory for three different energies of the π^+ mesons in the laboratory system. The results are shown graphically for two different coupling constants to show the dependence on the strength of the π meson-nucleon coupling. It is shown that a smaller coupling constant shifts the minima in the scattering cross section to higher angles. It would therefore seem possible to differentiate experimentally between the two types of coupling of the pseudoscalar theory.

1515

MESON MASSES AND ENERGETICS OF MESON DECAY. Walter H. Barkas. Am. J. Phys. 20, 5-13(1952) Jan.

A series of measurements of the π- and μ-meson masses and their decay energies is reviewed. Recent mass measurements made at the University of California Radiation Laboratory have employed an improved method in which the ratio of the π-meson mass to that of the proton and the ratio of the μ-meson mass to that of the π-meson were determined by measuring the ratios of ranges and ratios of momenta for particles of equal velocities. The absolute decay momentum of the μ-meson was also determined in the same series of experiments. Other experiments at the Radiation Laboratory in which quite different methods were used to obtain the π-meson mass and the decay energy of the μ-meson are also discussed. The measurements are consistent with a π-meson mass of 276 electron masses and a μ-meson mass of 210 electron masses. In addition, no contradiction is found for the assumptions that the $\pi-\mu$ decay is accompanied by a neutrino and the $\mu-e$ decay is accompanied by two neutrinos. (auth)

METEOROLOGY

1516

Massachusetts Inst. of Tech.
RESEARCH ON TURBULENCE AND DIFFUSION OF PARTICULATE MATTER IN THE LOWER LAYERS OF THE ATMOSPHERE; AUGUST 1–OCTOBER 31, 1950; by E. Wendell Hewson. Nov. 10, 1950. 46p. (NP-3538; Progress Report No. 8; U19653)

1517

Massachusetts Inst. of Tech.
RESEARCH ON TURBULENCE AND DIFFUSION OF PARTICULATE MATTER IN THE LOWER LAYERS OF THE ATMOSPHERE; MAY 1–JULY 31, 1950; by E. Wendell Hewson. Aug. 10, 1950. 15p. (NP-3539; Progress Report No. 7; U17819)

1518

Massachusetts Inst. of Tech.
RESEARCH ON TURBULENCE AND DIFFUSION OF PARTICULATE MATTER IN THE LOWER LAYERS OF THE ATMOSPHERE; NOVEMBER 1, 1949–JANUARY 31, 1950; by E. Wendell Hewson. Feb. 10, 1950. 40p. (NP-3540; Progress Report No. 5; U15660)

Refinements were made in the general instrumentation. More satisfactory counters for wind-speed measurements were installed on the stationary 144-ft tower. Aspirated radiation shields are being installed for ventilating the temperature-measuring equipment during summer operations. A hoist was provided to carry the smoke generator up the tower. A smoke densitometer is described which is for use in studies of the effect of diurnal variations of turbulence on the diffusion of particluate matter from elevated sources. The motion of small free no-lift balloons in a turbulent wind field was studied by a photogrammetric technique. The position, velocity, and acceleration components for each of 5 balloons are discussed. A gustometer was developed for making accurate measurements of the eddy components and determining their distribution in time and space. The gustometer consists of a no-lift balloon moored to a tower by thin elastic. The stretch of the elastic, which may be determined by a photogrammetric technique, is proportional to the applied force. Information was gained by motion-picture photography about the growth of smoke puffs which rise from the plume produced by the generator. The upward rate of growth of puffs was measured, and this rate was compared with their horizontal speed. The pattern of simultaneous fluctuations of wind direction as measured at 6 levels on the tower was studied. The development of instrumentation for the determination of eddy coefficients continued.

1519

Massachusetts Inst. of Tech.

RESEARCH ON TURBULENCE AND DIFFUSION OF PARTICULATE MATTER IN THE LOWER LAYERS OF THE ATMOSPHERE; NOVEMBER 1, 1950–JANUARY 31, 1951; by E. Wendell Hewson. Feb. 10, 1951. 47p. (NP-3541; Progress Report No. 9; U19942)

Data are presented for 4 wind-speed-fluctuation runs in which 2 hot-wire probes and 2 light wind vanes, mounted on a wooden crossbar oriented normal to the mean wind direction, were used simultaneously. Mean temperature and wind-speed data obtained from the portable tower are shown. The intensities of turbulence, or gustiness, were computed for each of 7 wind-speed runs. Larger values of the intensity tended to occur with lower values of the mean wind speed, which were associated with stable lapse rates. Analysis of the continuous, point-source smoke runs made at ground level and of the accompanying meteorological observations was completed. The standard deviation of wind direction, selected as an index of the horizontal turbulence in the air flow, varied inversely with stability and wind speed, and directly with wind direction.

1520

Massachusetts Inst. of Tech.

RESEARCH ON TURBULENCE AND DIFFUSION OF PARTICULATE MATTER IN THE LOWER LAYERS OF THE ATMOSPHERE; FEBRUARY 1–APRIL 30, 1951; by E. Wendell Hewson. May 10, 1951. 33p. (NP-3542; Progress Report No. 10)

Data on the intensity of air turbulence are presented for a series of measurements. Raw data for wind-speed observations are included. Analysis of smoke runs has continued in the study of the physical aspects of eddy motion in the lower layers of the atmosphere, and data are compared with values calculated from several empirical and theoretical formulas. Progress is reported in a study of temperature fluctuations under different meteorological conditions, at different elevations, and over various surfaces.

MOLECULAR PROPERTIES

1521

Research Lab. of Electronics, Mass. Inst. of Tech.

CENTRIFUGAL DISTORTION IN ASYMMETRIC MOLECULES; II. HDS; by R. E. Hillger and M. W. P. Strandberg. Oct. 5, 1950. 15p. (NP-3557; Technical Report No. 180; U61362)

A perturbation method for relating the theory of centrifugal distortion in asymmetric top molecules to observed microwave Q branch, a- or c-type transitions, is presented. The formula for the distortion correction is expressed in terms of the total angular momentum, J, the symmetry axis momentum of the nearest symmetric top, K, and five distortion constants. The formula yields a satisfactory fit to the observed spectrum of HDS ($\kappa \simeq -0.5$). The electric dipole moment is determined as 1.02 ± 0.02 Debye. The inertia defect and distortion constants are calculated. The effective structure for the HDS molecule so determined is in agreement with infrared determinations. (auth)

NUCLEAR PHYSICS

1522

Office of Naval Research, London

PROBLEMS OF QUANTUM PHYSICS; COPENHAGEN, DENMARK, JULY 6–10, 1951; by S. Fred Singer and V. F. Weisskopf. Aug. 24, 1951. 31p. (ONRL-77-51; U19456)

The topics discussed at the conference included (1) evidence for the existence of further heavy mesons; (2) systematizing present knowledge of heavy mesons; (3) determination, from underground experiments, of the interactions of μ mesons with the nucleus; (4) a review of theoretical and experimental work on nuclear forces; (5) various nuclear models with emphasis on attempts to harmonize the independent particle picture (shell model) with that of the compound nucleus used in the theory of nuclear reactions; (6) a new classical theory of electrons; and (7) status of the laws of causality in the theory of elementary particles.

1523

Office of Naval Research, London

NUCLEAR PHYSICS RESEARCH AT THE UNIVERSITIES OF BRUSSELS AND LOUVAIN; by John K. Beling. Sept. 10, 1951. 11p. (ONRL-83-51; U19430)

Apparatus at the Univ. of Brussels for research in low-energy nuclear physics and cosmic rays includes an 800-kev proton accelerator, β-ray spectrometer, and 25-cm cloud chamber. Two cases of positron annihilation without radiations have been observed in several thousand photographs of multiple and large-angle scattering of positrons and electrons. The energy loss of fast positrons and electrons in photographic emulsions is being investigated. The major publications of Prof. R. R. Roy, who heads the research, are cited. Equipment at the Univ. of Louvain, where Prof. M. de Hemptinne and his group are stressing low-energy nuclear physics, includes a 14-Mev cyclotron, 1-Mev Van de Graaff generator, 80-stage gaseous-diffusion isotope separator, and Mattauch-type mass spectrometer.

1524

EXPERIMENTS ON THE HIGH-ENERGY NUCLEONS AND QUANTA. John D. Cockcroft. Nature 168 1060-4(1951) Dec. 22.

A brief review of the developments in nuclear physics is given. The sections are entitled: The Ages of Nuclear Physics, Nuclear Forces, and Disintegration Produced by High-Energy Nucleus. The last section is mainly concerned with the contributions made by Harwell.

NUCLEAR PROPERTIES

1525

Brookhaven National Lab.

TOTAL CROSS SECTIONS FOR 14 MEV NEUTRONS; by H. L. Poss, E. O. Salant, G. A. Snow, and Luke C. L. Yuan. [nd] 36p. (BNL-1050)

With deuterons from the electrostatic generator of the Department of Terrestrial Magnetism incident on a tritium-Zr target, and with the neutrons detected by a terphenyl-zylene scintillator and photomultiplier, total cross sections of C, H, D, O and N for 14.10 ± 0.05-Mev neutrons were measured. The effective neutron energy was evaluated from the kinematics of the $T(d,n)He^4$ reaction, the dependence of the reaction's cross section on energy and angle, and the multiple scattering of the deuterons and their rate of energy loss in the target. A least-squares analysis of the transmissions of six thicknesses each of carbon and polyethylene (40 to 85% transmissions) yielded, for total cross sections in barns: $\sigma_C = 1.279 \pm 0.004$ and $\sigma_H = 0.689 \pm 0.005$. Transmissions of light and heavy water gave $\sigma_D = 0.803 \pm 0.014$ and $\sigma_O = 1.64 \pm 0.04$. Transmission of melamine gave $\sigma_N = 1.7 \pm 0.1$. (auth)

1526

Los Alamos Scientific Lab.

INELASTIC COLLISION AND TRANSPORT CROSS SECTIONS FOR SOME LIGHT ELEMENTS, by E. T. Jurney. Dec. 1951. 14p. (LA-1339)

Preliminary results are reported for inelastic collision and transport cross sections measured with threshold fission detectors and the fast-neutron beam from the Fast Reactor. The inelastic-collision cross section was arrived at by comparing the total cross section σ_t as measured by a transmission-type experiment with the total elastic-scattering cross section obtained separately by integrating a measured angular distribution of scattered neutrons over the entire sphere. A graph is given of the energy spectrum of the neutron beam from the reactor weighted by the energy dependence of the fission cross section of U^{238}. The total cross sections obtained from transmission measurements, together with the inelastic-collision and transport cross sections obtained from the angular distribution are tabulated for the scatterers Be, Al, Cr, Fe, Ni, and Cu. The individual angular distributions for the above-named scatterers are plotted.

NUCLEAR REACTORS

1527

Argonne National Lab.

MEASUREMENT OF CP-2 REACTOR TRANSFER FUNCTION, by J. M. Harrer, R. E. Boyar, and Darwin Krucoff. Jan. 1, 1950. 26p. (ANL-4373)

The reactivity of the CP-2 reactor was varied sinusoidally with time by oscillating the cadmium rod about its mean position. It is possible to describe the kinetic behavior of the reactor in terms of its response to the small-amplitude sinusoidal variations of reactivity. The phase and amplitude relations, when stated as functions of the driving frequency, are designated as the reactor transfer functions. It is shown that the experimental transfer function agrees reasonably well with the calculated transfer function.

NUCLEAR TRANSFORMATION

1528

Brace Lab. of Physics, Univ. of Nebraska

LOW ENERGY CROSS SECTIONS FOR THE D-D AND D-T REACTIONS; by Charles J. Cook, Emerson Jones, and Theodore Jorgensen. [nd] 10p. (AECU-1834)

Previous computations of cross sections for the D-D and D-T reactions were dependent upon the knowledge of the energy loss of deuterons and tritons in D_2O-ice targets. Recent unpublished experimental data on the energy loss dE/dx of protons in H_2 and O_2 have been sufficiently consistent to correct the results of the measurements of Bretscher, French, and Sidel (Phys. Rev. 73, 815(1948); 75, 1154(1949)). Without describing the methods used to obtain the new data, the author uses the results of the dE/dx measurements to correct the cross sections of Bretscher et al. A simple correction factor is given, and the corrected values are tabulated for the D-D and D-T reactions. The Gamow formula, modified by a resonance factor, is applied to the revised data, and a good fit to the theoretical slope is obtained.

1529

Atomic Energy Research Establishment, Harwell, Berks (England)

A BIBLIOGRAPHY ON FISSION. July 1951. 32p. (AERE Inf./Bib.-76)

This bibliography on fission is arranged in two parts. Part I contains references from published literature. The references were culled from Nuclear Science Abstracts, Science Abstracts, and Chemical Abstracts which have appeared since January 1946. Part II contains references of unclassified reports both from England and U. S. atomic energy projects.

1530

Brookhaven National Lab.

BETA AND GAMMA RADIATION OF Al^{28}, by Henry T. Motz and David E. Alburger. Dec. 11, 1951. 12p. (BNL-1057)

The β and γ rays occurring in the decay of Al^{28} have been measured by means of lens spectrometers using sources activated by the (n,γ) and (d,p) reactions on Al The γ ray has an energy of 1.782 ± 0.010 Mev, and the β-ray end point is found to be 2.865 ± 0.010 Mev. The total disintegration energy is consistent with nuclear reaction Q values linking Al^{28} and Si^{28}. It is shown that a discrepancy of 4×10^{-4} amu in the Si^{28}-Al^{27} mass difference exists when reaction data are compared to mass-spectroscopic values. A mass for Al^{27} of 26.990140 ± 0.000035 is proposed, based on Si^{28}, P^{31}, and S^{32} as standards. (auth)

1531

Ames Lab.

CLOUD CHAMBER IDENTIFICATION OF PHOTODEUTERONS FROM COPPER, by Warren H. Smith and L. Jackson Laslett. Dec. 1951. 32p. (ISC-189)

The object of the present investigation was to determine the relative yield (in equal range and solid-angle intervals) of photodeuterons and photoprotons produced by the irradiation of a thick Cu target with 65-Mev bremsstrahlung. A cloud chamber traversed by a magnetic field was employed in conjunction with the Iowa State College synchrotron to permit the observation of tracks formed by heavy photoparticles from the copper. A determination was made of the mean curvature of each track studied, in a fixed range interval extending between 4 and 14 cm from the end. Thus all protons had, except for straggling, a fixed energy interval and, similarly, the deuterons had another fixed energy interval. (auth)

1532

Ames Lab.

CLOUD CHAMBER IDENTIFICATION OF PHOTODEUTERONS FROM COPPER; by Warren H. Smith and L. Jackson Laslett. Jan. 18, 1952. 9p. (ISC-199)

The presence of a prominent group of photodeuterons, produced by the irradiation of Cu with 65-Mev bremsstrahlung, was demonstrated by experiments employing a 12-in. cloud chamber traversed by a magnetic field. The mean curvature of each acceptable track studied was determined over a fixed range interval; the distribution of the curvatures so obtained provided a clear indication of proton and deuteron groups. Helium was used as the noncondensable component of the cloud-chamber gas in order to reduce the effect of scattering. The spread in curvature produced by scattering was determined, for protons, by a control experiment in which essentially only protons were present, and the spread expected for deuterons under similar conditions was then readily estimated. The stopping power of the chamber gas was determined from the measured range of Po α particles and permitted computation of the expected mean curvatures for the unscattered trajectories of protons and of deuterons. Analysis of the experimental composite distribution curve, representing the particles obtained in the photodisintegration of Cu, into proton and deuteron components of the prescribed mean values and widths was then uniquely possible. The deuteron-to-proton ratio was thus found to be 0.7_6 for equal range and solid-angle intervals. It is estimated that the corresponding ratio for equal intervals of energy is ~0.5. (auth)

1533

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

NUCLEAR CHEMISTRY (ORGANIC), ONR GENERATOR, RADIOACTIVITY AND CYCLOTRON, SYNCHROTRON, AND THEORETICAL GROUPS, p.39-70 of PROGRESS REPORT; [AUGUST 31, 1951 TO NOVEMBER 30, 1951]. Nov. 30, 1951. 32p. (NP-3561(p.39-70))

Carbonium-ion rearrangements have been followed by using C^{14} as tracer and determining the radioactivity in all the positions. The effect of deuterium on various solvolytic reactions is being investigated. The 180° spectrograph and air-insulated generator have been used to study the following reactions: $Mg^{25}(d,\alpha)Na^{23}$, $Mg^{25}(d,p)Mg^{26}$, and $Mg^{26}(d,p)Mg^{27}$. Systematic measurement of nuclear-reaction energies by magnetic analysis has led to revision of the Q values of several reactions. Production and quenching of orthopositronium have been investigated, and an experiment is being prepared to measure the Zeeman effect of orthopositronium. The focusing of the outside beam of the cyclotron has been improved and is being used to study $(p,p\gamma)$ reactions; the γ spectrum from $C^{12}(p,p')C^{12*} \rightarrow C^{12} + \gamma$ is briefly described. The effect of negative ions on pulse-height-vs.-voltage characteristics of proportional counters has been investigated by adding CCl_4 to exaggerate the effect. The absorption coefficients of Cu, Sn, Ta, and Pb for Co^{60} γ rays were remeasured; it is concluded that the theoretical values for Cu and Sn agree well with experiment, while the predictions for Pb and Ta are less accurate but not different enough to determine the adequacy of the theory. Problems being considered by the theoretical group are briefly summarized; a few results but no calculations are given.

1534

Rochester Univ.

STARS INITIATED BY HIGH ENERGY PROTONS AND NEUTRONS, by Herbert Fishman and Alfred Morris Perry, Jr. Oct. 5, 1951. 20p. (NYO-905)

Stars initiated in nuclear emulsions by 240-Mev protons and 180-Mev neutrons have been studied. Size-frequency distributions of the stars and angular distributions of prongs in various energy intervals are shown graphically. Comparison with similar results obtained at different energies shows that the star-size distribution is more sensitive to incident energy for protons than for neutrons. (auth)

1535

Oak Ridge National Lab.

HIGH VOLTAGE PROGRAM, sect.4 of QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1951; PHYSICS DIVISION; by H. B. Willard, J. K. Bair, F. P. Green, T. M. Hahn, E. D. Klema, and C. W. Snyder. Issued Jan. 16, 1952. 7p. (ORNL-1092(sect.4))

In connection with reducing the neutron background from the 5-Mev Van de Graaff generator, thick-target (p,n) yields have been measured for Ta, W, Mo, and brass in the energy region 2.2 to 5.4 Mev. The $Be^9(p,n)B^9$ yield has been measured as a function of energy from the threshold at 2.059 0.002 Mev to 5.1 Mev. A new resonance was found at about 4.5 Mev. Using a Cockcroft-Walton generator, the γ-ray spectrum resulting from the resonance capture of 277-kev protons by N^{14} has been studied. Six γ rays from O^{15} are found. These can be correlated with the previously measured total excitation energy of the reaction only if three intermediate levels of O^{15} are assumed. Preliminary results on the capture of 300-kev He^3 nuclei by He^3 have been obtained. The most likely reaction is $He^3 + He^3 \rightarrow He^4 + H^1 + H^1 + 12.82$ Mev. (auth)

1536

National Research Council of Canada

NUMBER OF FISSIONS INDUCED IN A THIN DISC OF FISSILE MATERIAL BY A UNIFORM DISTRIBUTION OF NEUTRONS; by P. R. Wallace. Issued Aug. 16, 1945. 9p. (TPI-18)

1537

National Research Council of Canada

PRODUCTION OF NEUTRONS IN A THIN DISC DUE TO $(\alpha$-n) REACTION IN BERYLLIUM; by P. R. Wallace. Issued Aug. 16, 1945. 4p. (TPI-19)

1538

Radiation Lab., Univ. of Calif.

COMPARISON OF TOTAL PHOTONEUTRON YIELD FROM 160 AND 320 MEV BREMSSTRAHLUNG; by Lawrence W. Jones and Kent M. Terwilliger. Dec. 26, 1951. 4p. (UCRL-1618)

Total photoneutron yields from nine elements have been measured for 320-Mev and for 160-Mev bremsstrahlung from the Berkeley synchrotron. Neutrons were counted at 90° to the beam direction with a BF_3 proportional counter. The ionization-chamber beam monitor was calibrated at both energies for equivalent numbers of low-energy quanta by counting positrons from the $Cu^{63}(\gamma,n)Cu^{62}$ reaction and neutrons from the photodisintegration of deuterium. The ratios of total photoneutron yields (N_{320}/N_{160}) for equivalent $Cu^{63}(\gamma,n)$ and $D(\gamma,n)$ reaction yields (i.e., for the same number of quanta below 30 Mev) were Be, 1.21; C, 1.18; Al, 1.48; Fe, 1.23; Cu, 1.28; Mo, 1.30; Ta, 1.28; W, 1.33; and Pb, 1.30. If the calibration methods described can be assumed to normalize the beam to equal numbers of quanta between 0 and 30 Mev for full- and half-energy beams, the shapes of the bremsstrahlung spectra indicate that only quanta of greater than 140-Mev energy could account for the 30% increase in yield observed.

1539

THE ANGULAR DISTRIBUTION OF PROTONS IN THE PHOTO-DISINTEGRATION OF THE DEUTERON. K. Phillips. Phil. Mag. (7) 43, 129-33(1952) Jan.

Using a thin heavy wax target the angular distribution of photoprotons has been observed in photographic plates, for the energy range 6 to 15 Mev. Results are presented graphically.

1540

ON DETERMINATION OF THE CROSS SECTION OF URANIUM FOR THERMAL NEUTRONS. Georges Gueben. Ann. soc. sci. Bruxelles Sér. I, 65, 125-8(1951) Dec. 15. (In French)

The thermal-neutron-capture cross section of metallic U has been measured with a Ra-Be source and Ag, Rh, Dy, In, and Mn detectors (cf. NSA 5-4030 and 5-4492). The value obtained, 5.5 ± 1 barns, is compared with values in the literature.

PARTICLE ACCELERATORS

1541

Research Lab. of Electronics, Mass. Inst. of Tech.

THE M.I.T. LINEAR ELECTRON ACCELERATOR; by P. T. Demos, A. F. Kip, and J. C. Slater. May 31, 1951. 23p. (NP-3547; Technical Report No. 203)

The M.I.T. linear electron accelerator consists of a circular waveguide fitted with uniformly spaced irises, and sustains a standing-wave, transverse magnetic π mode oscillation at a resonant frequency of 2800 Mc. The phase velocity is equal to the velocity of light. Electrons are injected into the accelerating tube at an energy of 2 Mev by a standard Van de Graaff generator. Acceleration up to an energy of at least 18 Mev has been obtained, using the 21-foot length of the accelerator. Peak accelerated currents of the order of 10 ma, and average currents of the order of 1 μa, are obtained. The accelerator is fed by 21 tunable magnetrons (Raytheon RK5586), phased in synchronism. In this report the principles of design, constructional features, and operation are discussed. The accelerator is now being used for nuclear experimentation. (auth)

1542
STABILIZATION OF THE MAGNETIC FIELD OF THE LOUVAIN CYCLOTRON ELECTROMAGNET BY AMPLIDYNE. M. Y. Hecq and L. Gillon. Ann. soc. sci. Bruxelles Sér. I, 65, 142-8(1951) Dec. 15. (In French)

The cyclotron at the Centre de Physique Nucléaire of the University of Louvain, Belgium, has a 62-ton magnet, which produces an 18,000-gauss field in a 96-cm-diameter gap of 16.3-cm depth. The stabilization circuit is shown. A stability of 1/10,000 is obtained.

RADIATION ABSORPTION AND SCATTERING

1543
Nuclear Physics Lab., Case Inst. of Tech.
GAMMA RAY ABSORPTION COEFFICIENTS IN LEAD AND URANIUM AT 5 AND 10 MEV; by E. S. Rosenblum. Dec. 1, 1951. 38p. (AECU-1825)

Gamma-ray absorption coefficients in Pb and U are measured using betatron radiation, collimated to give "good" geometry. The analyzer was a 180° homogeneous magnetic-field pair spectrometer, with cyrstal-and-photomultiplier detectors. Experimentally determined coefficients are 0.497 cm^{-1} (Pb), 0.872 cm^{-1} (U) at 5.30 Mev, and 0.588 cm^{-1} (Pb), 1.028 cm^{-1} (U) at 10.31 Mev. These results are shown to indicate that the Bethe-Heitler calculation for the contribution caused by pair production is too high by an amount which decreases to zero near 5 Mev. Comparisons are made with the results of other investigators at higher and lower energies. (auth)

1544
Brookhaven National Lab.
THE IMPULSE APPROXIMATION; by Geoffrey F. Chew and Gian Carlo Wick. Brookhaven National Lab. and Carnegie Inst. of Tech. [nd] 21p. (BNL-1035)

An analysis is made of the assumption that the scattering of an elementary particle by a complex nucleus is well approximated by the superposition of outgoing waves generated by the individual nucleons acting independently. The special case of nucleon-nucleon scattering is discussed in detail and an estimate given of the order of magnitude of the error in the approximation. Application of the method to meson problems is also discussed. (auth)

1545
Microwave Lab., Stanford Univ.
RADIATIVE CORRECTION TO THE ANGULAR DISTRIBUTION OF NUCLEAR RECOILS FROM ELECTRON SCATTERING; by L. I. Schiff. Dec. 1951. 8p. (ML-153)

A rough calculation is made of the radiative correction to the Mott-Rutherford formula for elastic electron-nuclear scattering. This correction is required in order to compare theoretical results with experimental data in which the angle, but not the energy, of the nuclear recoil is measured. The following approximations are made: the Bethe-Heitler differential bremsstrahlung cross section is used as the starting point (Born approximation); the effect of the finite recoil velocity of the nucleus on the cross section is neglected; the dominant contribution to the bremsstrahlung cross section arises from events in which scattered electron and photon emerge within an angle of order mc^2/E_0 of the incident-electron direction, where m is the electron mass and E_0 its initial energy.

1546
Rochester Univ.
INELASTIC CROSS SECTIONS FOR 240-MEV PROTONS, by Alfred M. Perry, Jr. Oct. 5, 1951. 10p. (NYO-3028)

The mean free path for inelastic collisions of 240-Mev protons in Ilford G5 nuclear emulsions has been measured. In 99.07 m of proton track, 198 stars, 10 stoppings, 124 scatters of 4° or more, and 5 p-p scatters were found. Corrections were applied for scatters missed because of small horizontal projections, emulsion shrinkage, variation of ratio of cross section σ to geometrical area σ_0, number of diffraction scatters, etc. A mean free path $\lambda = 36.1$ (+2.6, −2.1) cm for inelastic collisions in emulsions was determined. The following inelastic cross sections for 240-Mev protons are listed:

	σ, barns	σ/σ_0^*
Ag	1.18 ± 0.08	0.87
Br	0.97 ± 0.07	0.87
O	0.25 ± 0.03	0.69
N	0.23 ± 0.03	0.69
C	0.21 ± 0.03	0.69

*for $r_0 = 1.37 \times 10^{-13}$

1547
Rochester Univ.
HIGH ENERGY NUCLEON-DEUTERON SCATTERING, by P. B. Daitch and J. B. French. Dec. 11, 1951. 7p. (NYO-3040)

Expressions for high-energy nucleon-deuteron scattering cross sections have been derived. Three graphs are given for the elastic-scattering cross sections for incident proton energies of 95, 146, and 240 Mev.

1548
Oak Ridge National Lab.
NEUTRON DIFFRACTION, sect.1 of QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1951; PHYSICS DIVISION; by E. O. Wollan, C. G. Shull, W. C. Koehler, and R. A. Erikson. Issued Jan. 16, 1952. 6p. (ORNL-1092(sect.1))

From neutron-diffraction measurements on two samples of Ba_2CO_3 enriched in C^{13}, the scattering amplitude of C^{13} has been determined to be positive with the magnitude 0.65 ± 0.03 × 10^{-12} cm. Structure factors for a few of the reflections of Ba_2CO_3 have been tabulated. FeF_2 and CoF_2 have been found to give superlattice neutron-diffraction peaks due to an ordered electron-spin structure in the temperature region 10 to 77°K. The temperature dependence of the intensity of the 100 superlattice diffraction peak has been measured and a theory for this dependence is proposed. The measurements are found to compare well with this theory for the three fluorides studied, MnF_2, FeF_2, and NiF_2. (auth)

1549
Oak Ridge National Lab.
INTERACTION OF LOW-ENERGY IONS WITH SOLIDS AND GASES, sect.3 of QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1951; PHYSICS DIVISION; by G. E. Evans, Paul Stier, C. F. Barnett, V. L. DiRito, and J. W. Schwartz. Issued Jan. 16, 1952. 2p. (ORNL-1092(sect.3))

A PIG-type ion source operating at a low gas pressure and power consumption has yielded stable heavy ion beams up to 400 μa. Apparatus is being set up to accelerate these beams to an energy in the range from 20 to 400 kev for study of their interaction with gases and solids. (auth)

1550
THE COULOMB SCATTERING OF CHARGED PARTICLES IN NUCLEAR EMULSIONS. W. Bosley and H. Muirhead. Phil. Mag. (7) 43, 63-71(1952) Jan.

Measurements have been made on the multiple coulomb scattering of electrons and protons in normal and diluted Ilford G5 emulsions. Empirical constants are given relating the mean angle of scattering to the product momentum × velocity for particles of unit charge. (auth)

1551

A NOTE ON THE SCATTERING OF IONS BY MOLECULES. Vernon Myers. J. Chem. Phys. 19, 1425(1951) Nov.

An upper limit to the cross section for capture of a H^+ ion by a H_2 molecule and subsequent photon emission is established. $\sigma_{cap}/\sigma_{dis} = 1 \times 10^{-9} E_2^2/E_1$, where E_2 is the photon energy in ev and E_1 is the energy of H^+ in ev relative to laboratory coordinates. $E_2 = \frac{2}{3}E_1 + \Delta$, where Δ is the energy required for dissociation of H_3^+ into H_2 and H^+. Δ is estimated to be of the order of 3 volts. The lower limit on E_1 set by experiment is about 1 volt. The cross section for photodisintegration of H_3^+ would be expected to be less than the "area" of the molecule. Taking the upper limit on σ_{dis} to be 1×10^{-15} cm^2 and E_1 to be 1 volt, the result is $\sigma_{cap} \leq 2 \times 10^{-23}$ cm^2. This cross section is insignificant in comparison to the scattering cross section of H_2 for the proton (4×10^{-15} cm^2 at this energy).

RADIATION EFFECTS

1552

Brookhaven National Lab.

PROGRESS REPORT ON FISSION PRODUCTS UTILIZATION; I. (UNCLASSIFIED SECTION) PRELIMINARY STUDIES ON INDUSTRIAL APPLICATIONS OF INTENSE GAMMA RADIATION; by B. Manowitz, R. V. Horrigan, and R. H. Bretton. Dec. 1, 1951. 15p. (BNL-141)

Progress is reported in a study of the possibilities for the utilization of the radioactive wastes produced as by-products of Pu separation processes. A survey of activity levels, completion of a study of volume and character of the fission-product wastes at various reactor stations, and initiation of scouting experiments on methods of extraction of the fission products are discussed. Production of intense radiation sources to be used for application development has progressed. Co^{60} and Ta^{182} sources, primarily for γ radiation, are reported. Interest in the project to provide irradiation service to industry is proved by the steady use of the service and the requests for the experimental sources received. Exploratory calculations indicate that chain-reacting chemical systems showed promise of ulilizing γ radiation effectively. Results of an investigation to determine the kinetics of styrene polymerization under the influence of γ radiation are reported.

RADIOACTIVITY

1553

Brookhaven National Lab.

BETA ACTIVITY OF Si^{31} AND THE MASSES OF THE Al AND Si ISOTOPES, by Henry T. Motz. Nov. 21, 1951. 7p. (BNL-1056)

The 2.6-hr β activity of Si^{31} was studied with a thin-lens spectrometer and a source prepared from the P^{31} (n,p) Si^{31} reaction. The β spectrum fitted to a Kurie plot for an allowed transition is shown. The end point found from a least-squares fit of a straight line to 17 points is 1471 ± 8 kev. Mass defects for nine isotopes of Al, Si, P, and S are listed as determined from Q values of reactions involving the isotopes obtained at MIT and from mass-spectrographic determination of Si^{28}, P^{31}, and S^{32} by Ewald (Z. Naturforsch. 6a, 293(1951)).

1554

Atomic Energy Project (Canada)

THEORY OF BETA-DECAY; by M. A. Preston. Sept. 15, 1950. 88p. (LT-29)

This account of β decay is based on a series of seven lectures delivered by the author during 1950 at the Atomic Energy Project, Chalk River, Ontario. The theory is developed from the beginning, and a detailed summary of some representative recent work is given. The chapter titles are Simple Theory, The Matrix Element, Forbidden Transitions, and Additional Selection Rules.

1555

Oak Ridge National Lab.

SHORT-LIVED ISOMERS, sect.2 of QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1951; PHYSICS DIVISION; by F. K. McGowan. Issued Jan. 16, 1952. 4p. (ORNL-1092(sect.2))

The radiation announcing the formation of an excited state in Dy^{160} with a half life of $1.8 \pm 0.2 \times 10^{-9}$ sec and the radiation resulting from its decay have been studied. The upper limits for the half life of excited states for Te^{123}, Te^{125}, Ho^{165}, Hg^{198}, and Tl^{203} are found to be in the range 4×10^{-10} to 20×10^{-10} sec. The corresponding γ-ray energies are given. The K-shell internal conversion coefficients have been measured for Dy^{160}, Ho^{165}, Er^{166}, and Yb^{170}. (auth)

1556

Radiation Lab., Univ. of Calif.

ALPHA RADIOACTIVITY OF NUCLIDES WITH ATOMIC NUMBERS LESS THAN 83 (thesis), by John Oscar Rasmussen, Jr. Dec. 14, 1951. 103p. (UCRL-1473(Rev.))

In a survey of cyclotron-produced neutron-deficient nuclides of the elements below Pb, α activity was detected in a number of rare-earth nuclides with atomic number greater than 62 and in a Au and a Hg nuclide. A detailed study of the α-active nuclides of Eu, Gd, Tb, and Dy was made. The trends of the rare-earth α-decay energies are discussed, particularly with relation to the abnormally decreased neutron-binding energies just beyond the closed shell of 82 neutrons. The relation between α-decay rates and energies in the rare-earth region is examined. Experimental values of α-decay energies are used to calculate predicted values of the rare-earth α-decay rates by extrapolation of four different α-decay-rate formulas adjusted to give agreement with α-decay-rate data of even-even nuclides in the heavy-element region. These predicted values are compared with the experimental values, and the problem of the determination of the "effective nuclear radius for α particles" is discussed. A brief review of various α-decay-rate treatments is made. A semiempirical correlation of α-decay-rate data of even-even nuclides of the heavy elements is carried out using a formula for the effective nuclear radius based on experimental α-particle-bombardment cross sections. Finally, a new many-body α-decay-rate formula, relating decay rate to nuclear-level spacing, is derived and discussed.

1557

HIGH-ENERGY COMPONENTS OF THE β-PARTICLE SPECTRUM OF $MsTh_2$. C. G. Campbell, W. J. Henderson, and J. Kyles. Phil. Mag. (7) 43, 126-7(1952) Jan.

An investigation of the β-particle spectrum of $MsTh_2$ (Ac^{228}) has been made using one-half of the double-semicircular focusing spectrometer. The Ac^{228} sources were found to be free from the decay products of Th. Moreover, for β particles of 1.8 Mev the half life of the sources used agreed within 1% of the accepted value. The maximum energy was extrapolated to be 2.16 ± 0.03 Mev. An attempt was made to deduce the end points of possible partial spectra by resolving the Fermi plot into straight lines, and this showed evidence of partial spectra with end points at 1.6 ± 0.1 Mev and 1.85 ± 0.1 Mev.

1558

A THEOREM INVOLVING BINDING ENERGIES IN RELATION TO β-DISINTEGRATION. N. Feather. Phil. Mag. (7) 43, 133-5(1952) Jan.

From time to time many expressions, equivalent so far as they are essentially correct, have been put forward to relate the energy released in β-disintegration to the masses of the nuclei involved, the total energy of binding of the neutrons and protons in such nuclei, or the masses of parent and daughter atoms in the neutral state. Sometimes the difference between the disintegration energies of successive β-active bodies (as of the successive members of a "chain" of fission products), or the difference between the disintegration energies of succeeding members of a series of bodies of constant isotopic number, is of interest. In such cases the "theoretical" expression for the energy difference may be neater than the corresponding expression for the energy of a single disintegration. In this note a form of expression is deduced for the difference between $T_\beta^-\left(\frac{A}{Z}\right)$ and $T_\beta^-\left(\frac{A'}{Z'}\right)$, the total energies of negative β-disintegration of two species $\left(\frac{A}{Z}\right)$ and $\left(\frac{A'}{Z'}\right)$, which exhibits this neatness in a marked degree. (auth)

1559

THE NATURAL RADIOACTIVITY OF RUBIDIUM. S. C. Curran, D. Dixon, and H. W. Wilson. Phil. Mag. (7) 43, 82-92(1952) Jan. (cf. NSA 5-7329)

The mode of decay of Rb^{87} is investigated chiefly by means of a shielded proportional tube operating as a spectrometer. It is shown to consist simply of a β transition between the ground states of Rb^{87} and Sr^{87}, the limiting energy of the particles being 275 kev and the average energy 44 kev. The spectrum, which was investigated using sources of thickness 1 mg/cm^2 and 0.128 mg/cm^2, shows no maximum, differs very considerably from that for an allowed transition and is in agreement qualitatively with that for a third-forbidden transition with parity change, $\Delta I = 3$, yes. The period is found to be $\tau = 6.15 \times 10^{10}$ yr. No γ rays, X rays or internal conversion electrons ascribable to the decay process are emitted in appreciable intensity. It is suggested that the established natural radioelements with $Z < 80$ form a well-defined and isolated group with log ft = 18 approximately. (auth)

1560

THE β SPECTRUM OF S^{35} BY THE NUCLEAR EMULSION METHOD; F. Gillain. Ann. soc. sci. Bruxelles Sér. I, 65, 135-41(1951) Dec. 15. (In French)

The possibility of determining low-energy β spectra by nuclear plates has been investigated. Application to S^{35} gave fair agreement with values obtained by other methods. The nuclear-emulsion method is particularly indicated when only traces of the radioisotope are available. 9 figures.

THEORETICAL PHYSICS

1561

Oak Ridge National Lab.

THEORETICAL PHYSICS, sect.9 of QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1951; PHYSICS DIVISION; by L. D. Roberts, ed. Issued Jan. 16, 1952. 6p. (ORNL-1092(sect.9))

Brief statements of mathematical activities during the period are presented. Calculations of L-shell internal-conversion coefficients, angular correlations of various radiations with conversion electrons, effect of orbital-electron screening on slowing of fission fragments, Racah coefficients, etc., are being carried out. The triplet force between like nucleons is discussed at some length.

1562

AN EQUATION FOR A PARTICLE WITH TWO MASS STATES AND POSITIVE CHARGE DENSITY. H. J. Bhabha. Phil. Mag. (7) 43, 33-47(1952) Jan.

A relativistic wave equation in the canonical form is given which describes a particle having two different rest masses. In one mass state the particle has a spin 3/2, in the other a spin 1/2. The free charge density is positive definite so that the equation can be quantized in the usual manner in accordance with the exclusion principle. The equation is irreducible. This example establishes the principle that irreducible multi-mass equations exist which can be used to form the basis of a physical theory along the usual lines, contrary to the general prevalent view. (auth)

1563

ON CALCULATION OF THE CROSS SECTION FOR EMISSION OF ELECTROMAGNETIC BREMSSTRAHLUNG. Gérard Petiau. Compt. rend. 233, 1581-3(1951) Dec. 19. (In French)

Equations for the differential cross section of the bremsstrahlung emission process are derived in the general formalism developed by the author (Compt. rend. 231, 1038(1950); 232, 153(1951)) by summing the polarization states of the emitted quantum. The method is that introduced by Feynman (Phys. Rev. 76, 780(1949)) and generalized by the author (J. phys. radium, in press).

PATENTS

CHEMISTRY

1564

METHODS OF FORMING URANIUM CARBIDE. R. W. Fisher (to U. S. Atomic Energy Commission). U. S. Patent No. 2,580,349, Dec. 25, 1951.

Uranium monocarbide is produced by heating U metal in contact with methane, or an aliphatic hydrocarbon, the hydrocarbon being in such amount that the C content thereof corresponds to about 4.8% by weight of the U metal content, at temperatures in the range of 400 to 1125°C.

1565

APPARATUS FOR THE PREPARATION OF METAL HALIDES. B. McDuffie, A. D. Schelberg, and R. W. Thompson (to U. S. Atomic Energy Commission). U. S. Patent No. 2,580,357, Dec. 25, 1951.

This patent describes apparatus for facilitating chemical reactions between a vaporizable solid and a nonvolatile solid comprising four interconnected chambers with associated controlled heating means.

1566

METHODS FOR STORING PERHALOACETYL PEROXIDE AND STABILIZED PERHALOACETYL PEROXIDE. W. T. Miller, A. L. Dittman, and S. K. Reed (to U. S. Atomic Energy Commission). U.S.Patent No. 2,580,358, Dec. 25, 1951.

This patent covers means for storage of a perhaloacetyl peroxide which comprises dissolving the peroxide immediately after preparation in a perhalomethane solvent, such as trichlorofluoromethane, and maintaining the resultant solution at a sub-zero temperature until it is put to use.

1567

PROCESSES FOR PREPARING PERHALOACETYL PEROXIDE. C. Zimmerman (to U. S. Atomic Energy Commission). U. S. Patent No. 2,580,373, Dec. 25, 1951.

This patent covers a method for the preparation of a perhaloacetyl peroxide, comprising dissolving either an alkali or alkaline earth metal peroxide in an aqueous brine solution, cooling the solution to a temperature between its freezing point and 0°C and adding to the cooled solution a perhalo derivative of acetic acid while maintaining the temperature of the solution in the aforementioned range.

1568

PROCESS FOR ELECTRODEPOSITING URANIUM DIOXIDE. M. Kahn (to U. S. Atomic Energy Commission). U. S. Patent No. 2,581,863, Jan. 8, 1952.

This patent describes a process for preparing thin films of metal compounds, such as U oxides and hydroxides, suitable for determination of the radioactivity thereof by counting techniques. The thin, uniform film of metal compound is produced by electrodeposition from an alkaline solution.

1569
PROCESSES OF PRODUCING URANIUM CHLORIDES. C. D. Wilder (to U. S. Atomic Energy Commission). U. S. Patent No. 2,582,941, Jan. 15, 1952.

In a process and apparatus for preparing U pentachloride and hexachloride by treating U oxides and lower U chlorides at an elevated temperature with a chlorinating agent comprising fast flowing stream of air admixed with carbon tetrachloride vapor, the gas stream carries the moderately volatile higher valent U chlorides away from the heated reaction zone to a collection zone maintained at a lower temperature.

1570
PROCESS FOR PRODUCING FLUOROCARBONS. R. D. Fowler, W. B. Burford, III, and H. C. Anderson (to U. S. Atomic Energy Commission). U. S. Patent No. 2,585,644, Feb. 12, 1952.

In a process for producing fluorocarbons containing a minimum of unsubstituted H atoms from hydrocarbons of from 17 to 23 C atoms such as petroleum lubricating oil, the petroleum oil is treated with Bi pentafluoride at an elevated temperature, in the range of 90 to 450°C, either by heating a mixture of the oil and the Bi pentafluoride, or by passing a vapor stream of the oil over a bed of the fluorinating agent. The reaction product is subjected to suitable separative procedures to obtain the highly fluorinated product.

ENGINEERING

1571
PIPE EXTRACTOR. S. L. Handforth (to U. S. Atomic Energy Commission). U. S. Patent No. 2,584,801, Feb. 5, 1952.

This novel clamp, suitable for extraction of vertical pipes from locations which are inaccessible, may be suspended at the end of a single supporting cable and is operated by remote control to lower it into the end of the pipe and then caused to grip and remove the same.

PHYSICS

1572
AUTOMATIC AIR BURST DIRECTION FINDER. G. A. Allard (to U. S. Atomic Energy Commission). U. S. Patent Application 255,501.

This patent application describes an atomic explosion direction indicator comprising a geometric heat-scorchable indicating surface symmetrical about an axis, elevation and azimuth markings on the heat scorchable surface, and an indicating rod at the axis of said surface arranged to cast a shadow thereon, whereby heat from an atomic explosion will scorch a pattern on said surface indicative of the azimuth and elevation of said explosion.

1573
METHOD OF ISOTOPE ANALYSIS. G. H. Dieke (to U. S. Atomic Energy Commission). U. S. Patent No. 2,585,901, Feb. 19, 1952.

This method of determining the isotopic composition of an element comprises incorporating the element in a compound capable of enhancing the corresponding spectral lines characteristic of the isotopes of the element, producing a spectrum of said compound, and ascertaining therefrom the relative abundance of the isotopes of the element.

1574
SPECTROMETER. R. W. Thompson and W. T. Leland (to U. S. Atomic Energy Commission). U. S. Patent No. 2,585,702, Feb. 12, 1952.

An improved ion source for a mass spectrometer comprises a coated thermionic ion source and a pair of flat electrodes suitably arranged to focus and direct the ions produced by the source.

1575
HIGH VOLTAGE REGULATOR. J. Priedigkeit (to U. S. Atomic Energy Commission). U. S. Patent No. 2,585,679, Feb. 12, 1952.

This h-v regulator circuit, stable over a large range of load conditions, is so designed that by making a few minor changes the polarity may be reversed. The circuit employs r-f coupling in combination with an amplifier to control operation of a regulator tube in opposition to fluctuations within the load circuit.

1576
REACTION COMPARISON APPARATUS. A. O. Hanson (to U. S. Atomic Energy Commission). U. S. Patent No. 2,585,649, Feb. 12, 1952.

In an apparatus which is useful in comparing the nuclear reactions of a plurality of samples, the materials to be compared are mounted in a back-to-back relationship within an ionization chamber so as to be irradiated simultaneously by an incident radiation beam. Collecting and measuring means associated with the ionization chamber make possible accurate comparison of the nuclear reactions.

1577
COMPENSATED ELECTRON DISCHARGE MEASURING DEVICE. W. C. Elmore (to U. S. Atomic Energy Commission). U. S. Patent No. 2,585,639, Feb. 12, 1952.

In an electronic device capable of measuring minute unidirectional currents, proper tube characteristic potentials are provided from a single d-c power supply by means of series resistance connections, thus eliminating the need for separate batteries. Indicating means are provided so that compensation may be readily made for any change in filament current. In addition, associated degenerative means give greater stability and more reliable measurements of the minute currents over a wide range.

1578
ELECTROPLATING CONTROL SYSTEM. M. L. Sands (to U. S. Atomic Energy Commission). U. S. Patent No. 2,584,816, Feb. 5, 1952.

An electronic electroplating control system is described which will maintain a constant potential between the cathode and the plating solution despite various changes in conditions which may occur during the electroplating operation.

1579
CALIBRATION UNITS FOR CATHODE-RAY TUBES. M. E. Chun (to U. S. Atomic Energy Commission). U. S. Patent No. 2,583,469, Jan. 22, 1952.

A calibration unit for cathode ray tubes employs a simple electrical circuit using standard parts, whereby an accurately calibrated system of grid lines is traced on the viewing screen of an oscilloscope prior to applying signal voltages to the deflecting plates.

1580
MASS SPECTROMETER ION SOURCES. F. L. Reynolds (to U. S. Atomic Energy Commission). U. S. Patent No. 2,583,121, Jan. 22, 1952.

This ion source mechanism, capable of easy and rapid insertion or removal in a mass spectrometer, without affecting the vacuum thereof, makes it possible to readily analyze a number of different samples.

1581
ELECTROMETERS FOR POCKET CHAMBERS. T. A. Rich and J. E. Bigelow (to U. S. Atomic Energy Commission). U. S. Patent No. 2,582,163, Jan. 8, 1952.

With an improved charging socket for use with a pocket ionization chamber, the electrometer has means to compensate for redistribution of charge and change of capacitance upon the removal or insertion of the pocket chamber so as to minimize the change of reading on a charge-indicating device, connected in parallel therewith, when inserting or removing the pocket chamber.

1582
X-RAY SHIELDS. P. Morrison (to U. S. Atomic Energy Commission). U. S. Patent No. 2,580,360, Dec. 25, 1951.

This patent pertains to a shield which substantially prevents the transmission of x rays, γ rays and other penetrating radiation. The shield comprises a U metal base which is coated with a heavy metal consisting of nonradioactive material of a density at least equal to that of red lead.

1583
NEUTRON DENSITY INDICATOR DEVICES. W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent No. 2,579,994, Dec. 25, 1951.

A neutron density detector which is stable and sensitive at both low and high neutron density comprises two members of dissimilar metals joined together to form a thermocouple or thermopile. The metals have low neutron-capture properties and are capable of developing thermoelectromotive force. One junction at least, or every other junction, is coated with a nonfissionable material having higher neutron-capture properties than the thermocouple members, thereby providing a hot junction.

1584
METHODS FOR THE PRODUCTION OF RADIOACTIVE ISOTOPES. A. F. Reid (to U. S. Atomic Energy Commission). U. S. Patent No. 2,579,243, Dec. 18, 1951.

In an improved target arrangement for producing certain radioactive isotopes, a layer of the metaborate of an alkali or alkaline earth metal bonded to a heat-conductive base is bombarded by a stream of high velocity, sub-atomic particles.

1585
REGULATED POWER SUPPLY. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent No. 2,579,223, Dec. 18, 1951.

This circuit utilizes a source of high d-c voltage and provides a h-v power supply characterized by high stability and high degree of regulation in the presence of sharp changes in the loading conditions. Frequency modulation is employed in the regulating loop. The regulation is performed at the ungrounded end of the power supply and the regulating sample voltage is derived at the low end of the regulated voltage supply output.

1586
ELECTROSTATIC GENERATORS. C. M. Turner (to U. S. Atomic Energy Commission). U. S. Patent No. 2,578,908, Dec. 18, 1951.

In an electrostatic accelerator employing an inert gas under pressure, the large ion beam is pulsed and bunched into alternate spaces of dense and sparse ionic density. Associated means provides for remotely adjusting the potential gradient between the h-v electrode and the intermediate electrode, and also between the latter electrode and the outer housing so that they may be made equal to one another. Improved evacuation means and the management for withdrawing nonionized vapor from the vicinity of the ion source result in reduction of scattering of ions from the beam as well as of x rays produced in the accelerating system.

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ADD - ABSTRACTS OF DECLASSIFIED DOCUMENTS the predecessor of NSA
NNES - National Nuclear Energy Series, published by the McGraw-Hill Book Company

Code designations are assigned as follows:
MDDC - To declassified reports released by the Manhattan Engineer District and by the Atomic Energy Commission before March 1, 1948
AECD - To declassified reports released by the Atomic Energy Commission after February 29, 1948 (appeared in April 15, Nuclear Science Abstracts)
AECU - To unclassified reports originating within the Atomic Energy Project. (Subsequent to AECU-871, this code is applied only to reports carrying no other recognized code designation.)

Other code designations below are assigned to unclassified reports by the originating installations

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1788	6-980	NSA
1789	6-955	NSA
1791	6-1076	NSA
1792	6-1134	NSA
1793	6-1093	NSA
1794	6-1094	NSA
1795	6-1070	NSA
1796	6-1077	NSA
1797	6-1110	NSA
1798	6-1111	NSA
1799	6-1078	NSA
1800	6-1071	NSA
1801	6-1079	NSA
1802	6-1108	NSA
1803	6-1080	NSA
1804	6-1226	NSA
1805	6-843	NSA
1806	6-1172	NSA
1809	6-1260	NSA
1810	6-1286	NSA
1811	6-1081	NSA
1812	6-1339	NSA
1813	6-1073	NSA
AERE-C/R-758	6-358	NSA
ANL-4488(p.54)	5-2323	Anat. Record 108, 572-3(1950)
BMI-RIJ-2	5-4425	J. Metals (N.Y.) 4, 153-6(1952)
3	5-4763	J. Metals (N.Y.) 4, 74-5(1951)
BNL-1002	6-292	NSA; Phys. Rev. 84, 1052(1951)
1017	6-316	Phys. Rev. 84, 1247-8(1951)
1020	6-733	Phys. Rev. 84, 1261-2(1951)
1021	6-626	NSA
1031	6-734	Phys. Rev. 84, 1260-61(1951)
ISC-105	6-573	$0.15
146	6-86	0.20
148	6-559	0.25
164	6-157	0.25
KAPL-638	6-107	Anal. Chem. 23, 1709-10(1951)
NP-3057	5-3695	J. Am. Chem. Soc. 73, 6762(1951)
NYO-524	6-1153	Phys. Rev. 84, 511-8(1951)
525	6-1154	J. Applied Phys. 22, 1380-4(1951)
781	5-4023	Rev. Sci. Instruments 22, 783-92(1951)

Report	Abstract	Availability
NYO-811	NSA 6-700	Phys. Rev. 84, 845-6(1951)
992	5-4749	J. Applied Phys. 22, 1260-4(1951)
1517	5-4875	$0.15
1614	5-759	0.10
3000	6-447	Phys. Rev. 84, 858-9(1951)
3033	6-338	Phys. Rev. 84, 1249(1951)
3450	6-211	$0.25
ORNL-1068	5-6400	0.30
1089	6-409	0.30
ORO-47	5-6198	0.35
RMO-835	6-212	0.20
SEP-44	5-4750	0.15
UCLA-132	5-3859	Ann. Allergy 9, 703-13, 726(1951)
UCRL-1067	5-2513	Chem. Revs. 49, 237-72(1951)
1386	6-167	$0.20
1412	6-168	0.10
1429	6-152	NSA
1483	6-153	NSA
1508	6-715	NSA; Phys. Rev. 84, 1069-70(1951)
1511	6-289	NSA
1512	6-284	NSA
1515	6-412	NSA
1516	6-413	NSA
1519	6-361	NSA
1520	6-388	NSA
1521	6-362	NSA
1522	6-319	NSA
1523	6-320	NSA
1524	6-389	NSA
1525	6-321	NSA
1527	6-390	NSA
1528	6-298	NSA
1529	6-322	NSA
1530	6-669	NSA
1531	6-363	NSA
1532	6-414	NSA
1533	6-415	NSA
1534	6-416	NSA
1535	6-656	NSA
1536	6-364	NSA
1537	6-323	NSA
1539	6-378	NSA
1541	6-379	NSA
1544	6-299	NSA
1545	6-324	NSA
1546	6-686	NSA
1547	6-737	NSA
1551	6-702	NSA
1552	6-703	NSA
1553	6-671	NSA
1554	6-717	NSA
1555	6-718	NSA
1556	6-687	NSA
1579	6-521	NSA
1593	6-1004	NSA
1595	6-974	NSA
1603	6-1005	NSA
1684	6-162	NSA

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

For a list of the abbreviations used in this section, see NSA, Vol. 6, No. 1, page "SUPPLEMENT 1".

$_1H_1^2$	μ 0.857615* I 0.857611** $^*\nu_D/\nu_H = 0.15350733 \pm 0.00000007$ $^{**}\nu_D/\nu_H = 0.15350669 \pm 0.00000012$	G. Lindström, Arkiv Fysik 4, 1(1951). *D_2O; paraffin oil **D_2O; H_2O.
He	σ_s coh 1.1	A. W. McReynolds, Phys. Rev. 84, 969(1951). Assuming σ_s coh(O) = 4.2.
$_3Li_4^7$	μ 3.2568 I $\nu(Li)/\nu(H) = 0.3886341 \pm 0.0000010$	G. Lindström, Arkiv Fysik 4, 1(1951). [$LiNO_3$].
$_3Li_4^7$	No 4.8 γ Li(p,p) scin	H. E. Gove, Phys. Rev. 84, 1059(1951).
$_3Li_4^7$	Levels 0.4782 Li^7(p,p) 0.4775 Li^7(d,d)	R. M. Williamson et al., Phys. Rev. 84, 731(1951).
$_4Be_5$[illegible]	Level $Be^9(\alpha,\alpha)$ 2.63	W. O. McMinn et al., Phys. Rev. 84, 963(1951).
$_5B_6^{11}$	μ 2.6887 I $\nu(B)/\nu(H) = 0.3208381 \pm 0.0000008$	G. Lindström, Arkiv Fysik 4, 1(1951). [$Na_2B_2O_4$] and [$K_2B_2O_4$].
$_5B_6^{11}$	γ's B^{10}(d,p) 4.43 7.34 } pair s 6.75 8.93 }	S. J. Bame, L. M. Baggett, Phys. Rev. 84, 891(1951). E_d = 1.4.
$_5B_6^{11}$	Level $Be^9(\alpha$,d) 2.18	W. O. McMinn et al., Phys. Rev. 84, 963(1951).
$_5B_7^{12}$	Levels $Be^9(\alpha$,p) 0.95, 1.65, 3.82	W. O. McMinn et al., Phys. Rev. 84, 963(1951).
$_6C_6^{12}$	γ 4.37 Be(α,n) $\sim 2.5\gamma/4.4\gamma < 0.3$ pair s $\sim 7\gamma/4.4\gamma < 0.002$	K. P. Artemov, N. A. Viasov, Doklady Akad. Nauk S.S.S.R. 77, 225 (1951) in Guide to Russ. Sci. Per. Lit. 4, 235(1951)
N	σ_s coh 11	A. W. McReynolds, Phys. Rev. 84, 969(1951). Assuming σ_s coh (O) = 4.2.
N	σ_t(0.15 – 1.45) curve E_0 — Γ — J 0.640 — 40-55 kev — ½ 1.00 — 45-60 kev — 3/2	C. H. Johnson et al., Phys. Rev. 84, 775(1951). Other resonances observed at 0.433, 1.12, 1.35, 1.45.
$_7N_7^{14}$	Levels $O^{16}(d,\alpha)$ 3.99, 5.07 ppl	H. B. Burrows et al., Proc. Roy. Soc. (London) 209A, 478(1951).
$_8O_8^{16}$	σ_t(~2 – 4.1 Mev) E_0 — Γ — Level 1.9 — — $p_{1/2}$ 2.35 — 0.18 — $s_{1/2}$ 3.33 — 0.22 — $d_{3/2}$ 3.80 — 0.80 — $p_{3/2}$ 4.40 — 0.28 — $p_{1/2}$	E. Baldinger et al., Phys. Rev. 84, 1058(1951).
$_8O_9^{17}$	Levels O^{16}(d,p); $F^{19}(d,\alpha)$ 0.87 5.31 7.51 3.06 5.76 8.27* 3.85 6.24 8.59* 4.58 6.89 9.06* 5.07 ppl	H. B. Burrows et al., Proc. Roy. Soc. (London) 209A, 478(1951). E_d ~8 Mev. *$F^{19}(d,\alpha)$ only. *Observed p and α groups at several angles.
$_9F_{10}^{19}$	μ 2.6282* I 2.6284** $\nu(F)/\nu(H) = 0.9408545^* \pm 0.0000030$ $\nu(F)/\nu(H) = 0.9409330^{**} \pm 0.0000030$	G. Lindström, Arkiv Fysik 4, 1(1951). *[$CHFCl_2$], **[$CFCl_3$]. Ratio different for six compounds tested.
$_9F_{10}^{19}$	Levels $O^{16}(\alpha$,p) 1.36, 2.67, 3.92	M. L. Bullock, M. B. Sampson, Phys. Rev. 84, 967(1951).
$_9F_{11}^{20}$	Levels F^{19}(d,p) 0.63 2.55 4.06 0.83 2.91 4.31 1.00 3.49 4.73 1.37 ppl	H. B. Burrows et al., Proc. Roy. Soc. (London) 209A, 478(1951).
$_{11}Na_{12}^{23}$	μ 2.2167 I $\nu(Na)/\nu(H) = 0.2645182 \pm 0.0000007$	G. Lindström, Arkiv Fysik 4, 1(1951). [NaBr].
$_{12}Mg_{11}^{23}$	τ 12.3^s β^+ 2.99 scin	F. I. Boley, D. J. Zaffarano, Phys. Rev. 84, 1059 (1951).
$_{13}Al_{14}^{27}$	μ 3.6394 I $\nu(Al)/\nu(H) = 0.2605694 \pm 0.0000010$	G. Lindström, Arkiv Fysik 4, 1(1951). [$AlCl_3$].
$_{13}Al_{14}^{27}$	Levels Al(d,d) 0.97 4.74 2.39 5.76 3.17	K. K. Keller, Phys. Rev. 84, 884(1951). E_d = 10.4 Mev.
$_{13}Al_{15}^{28}$	Levels Al(d,p) 1.04 3.98 6.40 1.58 4.83 6.90 2.17 5.16 7.40 2.52 5.80 8.50 3.47 6.10	K. K. Keller, Phys. Rev. 84, 884(1951). E_d = 10.4 Mev.

${}_{14}\mathrm{Si}^{27}_{13}$	τ 5.4^{s} β^{+} 3.48 scin	F. I. Boley, D. J. Zaffarano, Phys. Rev. 84, 1059(1951).
${}_{16}\mathrm{S}^{31}_{15}$	τ 3.2^{s} β^{+} 4.06 scin	D. J. Zaffarano, F. I. Boley, Phys. Rev. 83, 223(A)(1951) and 84, 1059(1951).
${}_{17}\mathrm{Cl}^{33}_{16}$	τ 1.8^{s} β^{+} 4.43 scin	D. J. Zaffarano, F. I. Boley, Phys. Rev. 83, 223(A)(1951) and 84, 1059(1951).
A	σ_s coh 0.5	A. W. McReynolds, Phys. Rev. 84, 969(1951). Assuming σ_s coh(O) = 4.2.
${}_{19}\mathrm{K}^{37}_{18}$	τ 1.2^{s} β^{+} 4.57 scin	F. I. Boley, D. J. Zaffarano, Phys. Rev. 84, 1059(1951).
${}_{19}\mathrm{K}^{40}_{21}$	γ (Auger e^-) coincidences	M. Paganelli, G. Quareni, Nuovo Cimento 8, 598 (1951).
${}_{19}\mathrm{K}^{42}_{23}$	$\beta\gamma(\theta)$ indicates I = 2+ for 1.51 level of Ca^{42} $b = -0.055$ for $E_\beta = 1.23$	D. T. Stevenson, M. Deutsch, Phys. Rev. 84, 1071(1951).
${}_{20}\mathrm{Ca}^{39}_{19}$	τ 1.1^{s} β^{+} 5.13 scin	F. I. Boley, D. J. Zaffarano, Phys. Rev. 84, 1059(1951).
${}_{25}\mathrm{Mn}^{55}_{30}$	σ_t (0.08 – 1.0) graph	W. F. Stubbins, Phys. Rev. 84, 902(1951).
${}_{26}\mathrm{Fe}^{59}_{33}$	τ 47.1 ± 0.5^{d}	J. Tobailen, Compt. rend. 233, 1360(1951). Differential ic's.
${}_{27}\mathrm{Co}^{59}_{32}$	σ_t (0.08 – 1.0) graph	W. F. Stubbins, Phys. Rev. 84, 902(1951).
${}_{27}\mathrm{Co}^{60}_{33}$	τ 5.27 ± 0.07^{y}	J. Tobailen, Compt. rend. 233, 1360(1951). Differential ic's.
${}_{29}\mathrm{Cu}^{66}_{37}$	τ 5.17 ± 0.07^{m} β^{-} 5.5% 1.6 scin; $\beta\gamma$ 94.5% 2.7 scin γ 1.05 scin $\beta\gamma$ delay $< 5 \times 10^{-9s}$	H. Roderick et al., Phys. Rev. 84, 887(1951). Cu(slow n,γ).
${}_{30}\mathrm{Zn}^{65}_{35}$	$X\gamma$ show 44 ± 3% of K's go to 1.11 level	S. E. Furberg, Nature 168, 1005(1951).
${}_{31}\mathrm{Ga}^{67}_{36}$	τ 77.9 ± 0.3^{h}	J. Tobailen, Compt. rend. 233, 1360(1951). Differential ic's.
${}_{34}\mathrm{Se}^{73}_{39}$	τ 7.08^{h} β^{+} 1.1% 0.250 sπ 10.3% 0.750 87.4% 1.318 1.2% 1.680 γ 0.0671 ce^-,pe^- K/L = 7.6 0.361 ce^-,pe^- K/L = 8.6 0.860 pe^- 1.310 cpt	F. R. Scott, Phys. Rev. 84, 659(1951).
${}_{37}\mathrm{Rb}^{87}_{50}$	τ $(7.6 \pm 0.4) \times 10^{10y}$	G. Charpak, F. Suzor, Compt. rend. 233, 1356 (1951).
Mo	σ_t(0.01 – 1.23) graph	W. F. Stubbins, Phys. Rev. 84, 902(1951).
${}_{50}\mathrm{Sn}^{119}_{69}$ $\geq 100^{d}$	γ 0.0238 pc $\alpha = 7$	J. C. Bowe, P. Axel, Phys. Rev. 84, 939(1951).
${}_{53}\mathrm{I}^{126}_{73}$	$\beta\gamma(\theta)$ curve indicates I = 2+ for 0.39 level of Xe^{126}.	D. T. Stevenson, M. Deutsch, Phys. Rev. 84, 1071(1951).
${}_{57}\mathrm{La}^{138}_{81}$	τ 2.0×10^{11y} γ 51% 0.535 scin 33% 0.807 15% 1.390 <0.2 particles/sec/g with E > 0.1. Ba x-ray?	R. W. Pringle et al., Phys. Rev. 84, 1066(1951).
${}_{57}\mathrm{La}^{140}_{83}$	$(2.26\beta)(1.60\gamma)$ $(1.60\gamma)(0.82\gamma)$ $\gamma\gamma(\theta)$ indicates I = 4+, 2+, 0+ for 2.42, 1.60, 0 levels in Ce^{140}.	B. L. Robinson, L. Madansky, Phys. Rev. 84, 1067(1951).
${}_{57}\mathrm{La}^{141}_{84}$	β^{-} ~5 0.9 sl ~95 2.43 γ low intensity scin, $\beta\gamma$	R. B. Duffield, L. M. Langer, Phys. Rev. 84, 1065(1951).
${}_{58}\mathrm{Ce}^{141}_{83}$	γ 0.141 scin No γ $0.3 < E_\sigma < 0.6$ $\beta\gamma$	R. B. Duffield, L. M. Langer, Phys. Rev. 84, 1065(1951).
${}_{81}\mathrm{Tl}^{208}_{127}$	$H_\rho(L) = 2607.17 \pm 0.30$ γ_L 510.85 ± 0.08 kev	G. Lindström, Arkiv Fysik 4, 1(1951). Used γ_p of Thomas et al., Phys. Rev. 78, 787(1950).
${}_{82}\mathrm{Pb}^{212}_{130}$	$H_\rho(I) = 1754.01 \pm 0.20$ $H_\rho(F) = 1388.56 \pm 0.15$ γ_1 238.63 ± 0.04 kev	G. Lindström, Arkiv Fysik 4, 1(1951). Used γ_p of Thomas et al., Phys. Rev. 78, 787(1950).
${}_{83}\mathrm{Bi}^{207}_{124}$	γ ~100% 0.56 scin ~100% 1.1 $\gamma\gamma$, Pb K x ray	M. A. Grace, J. R. Prescott, Phys. Rev. 84, 1059(1951).
${}_{86}\mathrm{Rn}^{222}_{136}$	τ 3.825 ± 0.0005^{d}	J. Tobailen, Compt. rend. 233, 1360(1951). Differential ic's.
${}_{91}\mathrm{Pa}^{234?}_{143}$ 1.14^{m}	Possible n emitter	M. da Silveira, Portugaliae Phys. 1, 167(1945).
${}_{91}\mathrm{Pa}^{234}_{143}$ 1.14^{m}	n radiation assigned to UX_2^* probably is from spontaneous fission of U^{235}.	M. E. Nahmias, Compt. rend. 233, 1185(1951). *M. da Silveira, Portugaliae Phys. 1, 167(1945).

Q's Between Ground States

$T(d,\alpha)n$ $\mathrm{Li}^6(p,\alpha)\mathrm{He}^3$	17.578 – 0.030 4.024 ± 0.005	R. M. Williamson et al., Phys. Rev. 84, 731(1951).
$\mathrm{Be}^8 \rightarrow 2\mathrm{He}^4$ $\mathrm{Be}^9(p,\alpha)\mathrm{Li}^6$	0.0775 ± 0.004 2.130 ± 0.010	R. R. Carlson, Phys. Rev. 84, 749(1951).
$\mathrm{Be}^9(p,\alpha)\mathrm{Li}^6$ $\mathrm{Be}^9(d,\alpha)\mathrm{Li}^7$	2.123 ± 0.004 7.159 ± 0.009	R. M. Williamson et al., Phys. Rev. 84, 731(1951).

$\mathrm{Li^{7}(d,p)Li^{8}}$	−0.192 ± 0.001	
$\mathrm{Be^{9}(p,d)Be^{8}}$	0.558 ± 0.002	
$\mathrm{Be^{9}(p,d)Be^{8}}$	0.558 ± 0.005	R. R. Carlson, Phys. Rev. 84, 749(1951).
$\mathrm{O^{16}(d,\alpha)N^{14}}$	3.09 ± 0.02	H. B. Burrows et al., Proc. Roy. Soc. (London) 209A, 478(1951).
$\mathrm{O^{16}(d,p)O^{17}}$	1.93 ± 0.01	
$\mathrm{F^{19}(d,\alpha)O^{17}}$	10.04 ± 0.02	
$\mathrm{O^{16}(\alpha,p)F^{19}}$	−8.08 ± 0.1	M. L. Bullock, M. B. Sampson, Phys. Rev. 84, 967(1951).
$\mathrm{F^{19}(d,p)F^{20}}$	4.39 ± 0.03	H. B. Burrows et al., Proc. Roy. Soc. (London) 209A, 478(1951).
$\mathrm{Al^{27}(d,p)Al^{28}}$	5.53	K. K. Keller, Phys. Rev. 84, 884(1951).

Packing Fraction Differences, Δf, in Units 10^{-4} amu

Entries under both members of doublets except for those involving hydrocarbons

Doublet	Δf	Reference
$\mathrm{S^{32} - O_2}$	−5.550 ± 0.002	T. L. Collins et al., Phys. Rev. 84, 717(1951).
$\mathrm{S^{32}O - C_4}$	−6.902 ± 0.003	
$\mathrm{CO_2 - C_3H_8}$	−16.558 ± 0.004	
$\mathrm{S^{32} - Ni^{64}}$	+2.65 ± 0.02	H. E. Duckworth et al., Phys. Rev. 83, 1114(1951).
$\mathrm{S^{33}O - C_4H}$	−8.446 ± 0.009	T. L. Collins et al., Phys. Rev. 84, 717(1951).
$\mathrm{S^{34}O - C_4H_2}$	−10.580 ± 0.008	
$\mathrm{HCl^{35} - C_3}$	−6.484 ± 0.012	
$\mathrm{HCl^{37} - C_3H_2}$	−11.056 ± 0.012	
$\mathrm{A^{36} - C_3}$	−9.028 ± 0.009	
$\mathrm{A^{36} - H_2O}$	−14.899 ± 0.015	T. L. Collins et al., Phys. Rev. 84, 717(1951).
$\mathrm{A^{38} - C_3H_2}$	−13.924 ± 0.010	
$\mathrm{K^{39} - C_3H_3}$	−15.360 ± 0.007	
$\mathrm{K^{41} - C_3H_5}$	−18.869 ± 0.008	
$\mathrm{Ca^{42} - C_3H_6}$	−21.011 ± 0.008	
$\mathrm{Ca^{43} - C_3H_7}$	−22.335 ± 0.012	
$\mathrm{Ca^{44} - CO_2}$	−7.865 ± 0.013	
$\mathrm{Ca^{48} - C_4}$	−9.915 ± 0.021	
$\mathrm{Sc^{45}O - C_2O_2H_5}$	−12.839 ± 0.007	
$\mathrm{Ti^{47} - Pr^{141}}$	−3.64 ± 0.03	H. E. Duckworth et al., Phys. Rev. 83, 1114(1951).
$\mathrm{Fe^{58} - Th^{232}}$	−13.17 ± 0.06	G. S. Stanford, H. E. Duckworth, Phys. Rev. 83, 229 (A)(1951).
$\mathrm{Ni^{60} - Hf^{180}}$	−8.57 ± 0.03	H. E. Duckworth et al., Phys. Rev. 83, 1114(1951).
$\mathrm{Ni^{64} - O^{16}}$	−8.25 ± 0.03	
$\mathrm{Ni^{64} - S^{32}}$	−2.65 ± 0.02	
$\mathrm{Cu^{63} - Te^{126}}$	−3.61 ± 0.07	
$\mathrm{Cu^{65} - Te^{130}}$	−3.98 ± 0.06	
$\mathrm{Zn^{64} - Te^{128}}$	−3.91 ± 0.07	
$\mathrm{Ge^{70} - Ce^{140}}$	−4.25 ± 0.03	
$\mathrm{Ge^{72} - Nd^{144}}$	−4.85 ± 0.07	
$\mathrm{Ge^{73} - Nd^{146}}$	−4.64 ± 0.08	
$\mathrm{Kr^{82} - C_3H_5}$	−20.219 ± 0.03	C. L. Kegley, H. E. Duckworth, Phys. Rev. 83, 229(A)(1951).
$\mathrm{Sr^{88} - Hf^{176}}$	−7.11 ± 0.04	H. E. Duckworth et al., Phys. Rev. 83, 1114(1951).
$\mathrm{Y^{89} - Hf^{178}}$	−7.07 ± 0.05	
$\mathrm{Zr^{90} - Hf^{180}}$	−7.70 ± 0.03	
$\mathrm{Zr^{91} - W^{182}}$	−7.45 ± 0.04	
$\mathrm{Zr^{92} - Ba^{138}}$	−3.58 ± 0.05	
$\mathrm{Zr^{92} - W^{184}}$	−7.53 ± 0.04	
$\mathrm{Mo^{94} - Pr^{141}}$	−2.54 ± 0.05	
$\mathrm{Mo^{96} - Nd^{144}}$	−3.66 ± 0.03	
$\mathrm{Mo^{100} - Nd^{150}}$	−4.09 ± 0.04	
$\mathrm{Sn^{116} - Th^{232}}$	−9.89 ± 0.03	G. S. Stanford, H. E. Duckworth, Phys. Rev. 83, 229(A)(1951).
$\mathrm{Sn^{119} - U^{238}}$	−10.24 ± 0.03	
$\mathrm{Te^{126} - Cu^{63}}$	+3.61 ± 0.07	H. E. Duckworth et al., Phys. Rev. 83, 1114(1951).
$\mathrm{Te^{128} - Zn^{34}}$	+3.91 ± 0.07	
$\mathrm{Te^{130} - Cu^{65}}$	+3.98 ± 0.06	
$\mathrm{Te^{130} - Pt^{195}}$	−5.45 ± 0.11	
$\mathrm{Xe^{129} - C_3H_7}$	−20.15 ± 0.02	C. L. Kegley, H. E. Duckworth, Phys. Rev. 83, 229(A)(1951).
$\mathrm{Xe^{129} - C_2OH_3}$	−11.68 ± 0.02	
$\mathrm{Xe^{132} - C_2OH_4}$	−13.08 ± 0.02	
$\mathrm{Xe^{132} - CO_2}$	−4.90 ± 0.02	
$\mathrm{Ba^{138} - Zr^{92}}$	+3.58 ± 0.05	H. E. Duckworth et al., Phys. Rev. 83, 1114(1951).
$\mathrm{Ce^{140} - Ge^{70}}$	+4.25 ± 0.03	
$\mathrm{Pr^{141} - Ti^{47}}$	+3.64 ± 0.03	
$\mathrm{Pr^{141} - Mo^{94}}$	+2.54 ± 0.05	
$\mathrm{Nd^{144} - Ge^{72}}$	+4.85 ± 0.07	H. E. Duckworth et al., Phys. Rev. 83, 1114(1951).
$\mathrm{Nd^{144} - Mo^{96}}$	+3.66 ± 0.03	
$\mathrm{Nd^{146} - Ge^{73}}$	+4.64 ± 0.08	
$\mathrm{Nd^{150} - Mo^{100}}$	+4.09 ± 0.04	
$\mathrm{Hf^{176} - Sr^{88}}$	+7.11 ± 0.04	
$\mathrm{Hf^{180} - Ni^{60}}$	+8.57 ± 0.03	
$\mathrm{Hf^{180} - Zr^{90}}$	+7.70 ± 0.03	
$\mathrm{Hf^{178} - Y^{89}}$	+7.07 ± 0.05	
$\mathrm{W^{182} - Zr^{91}}$	+7.45 ± 0.04	
$\mathrm{W^{184} - Zr^{92}}$	+7.53 ± 0.04	
$\mathrm{Pt^{195} - Te^{130}}$	+5.45 ± 0.11	
$\mathrm{Th^{232} - Fe^{58}}$	+13.17 ± 0.06	G. S. Stanford, H. E. Duckworth, Phys. Rev. 83, 229(A)(1951).
$\mathrm{Th^{232} - Sn^{116}}$	+9.89 ± 0.03	
$\mathrm{U^{238} - Sn^{119}}$	+10.24 ± 0.03	

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